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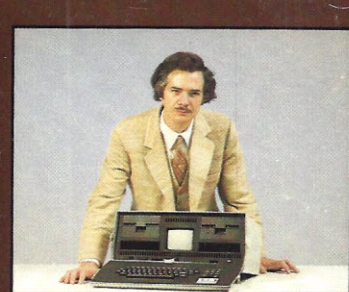
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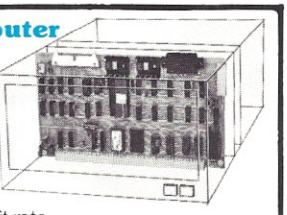


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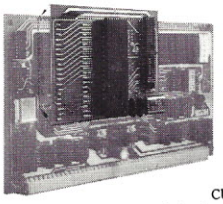


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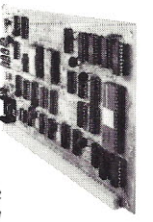


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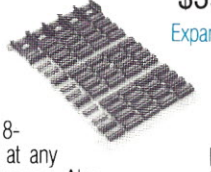
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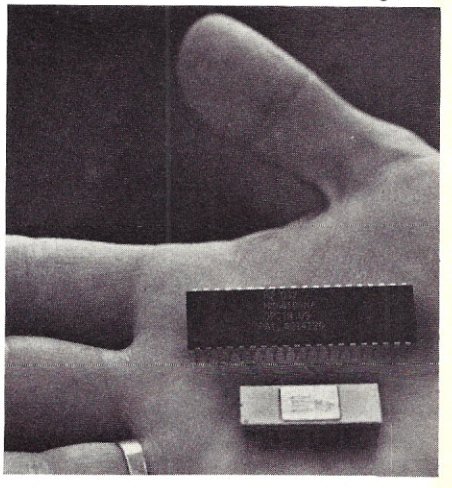
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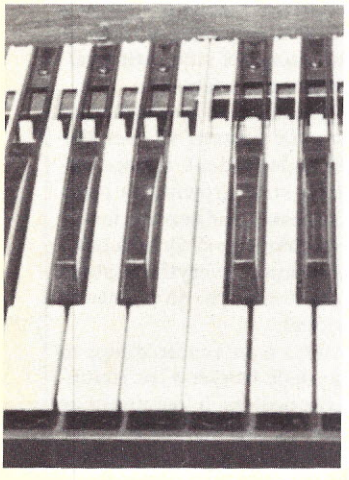
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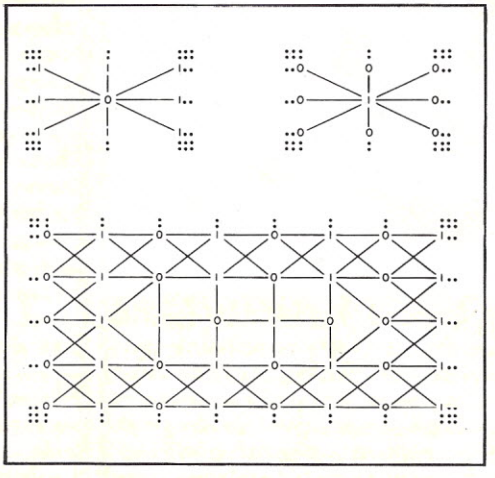
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This month:

This month's cover (by Martin Paul) entitled "Trash Your Typewriter" dramatically illustrates a point that many computerists have known for a long time: You no longer have to suffer the drudgery and tedium of typing; there is a better way. It is inevitable that if you own a microcomputer, sooner or later you will want to do word processing on it.

To help you discover what to look for, what systems are available and how to use them, we have devoted a large section of the magazine to word processing. We've included a software directory which provides a sampling of word processing systems, their costs, the manufacturer and some of their features. More in-depth reviews on other systems are also provided. You'll learn how word processing allows you, with the ease of a few keystrokes, to manipulate text, make corrections and produce copies. Word processing makes writing easier, particularly where drafts and multiple letters are required.

It is not surprising, then, that several of this issue's word-processing application articles were written by professional writers, whose livelihood depends on efficiently processing written words. Our contributors attest that word processing saves time, makes text composition easier and, in at least one case, improves the quality of work.

But, with such advanced features as automatic spelling correction and hyphenation, word processing is seen by others as a threat to our language skills and as an impersonalizing factor in human correspondence. Will processed words, like processed food, dull our senses? Or is it just another tool we must learn to use to survive in this world where speed in communication is vital?

For good or bad, as our cover states, word processing is here!

—The Editors

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By Wayne Green

Wanted: Workers To Help Industry Grow



Job Opportunities

The microcomputer field will be needing tens of thousands of people over the next few years. Seldom before have we seen as many opportunities for people to get into a new field and go so far so quickly.

For instance, we need hundreds, or perhaps even thousands, of engineers and technicians to help the manufacturers keep up with the state of the art in technology. This is going to take a rather substantial percentage of the budget because the art is going to be moving so rapidly.

Then these firms need a full complement of people for management, advertising, production, packaging, shipping, bookkeeping, accounting, marketing, personnel, data processing, etc. Importers will have their special problems, with service, distribution, warehousing, keeping reps in line, advertising, etc.

Next we have the programming business. The larger program publishers such as Instant Software will need many of the same type of people as the manufacturers—employees for advertising, quality control, personnel, handling, packing, shipping, bookkeeping, accounting, marketing, warehousing, evaluation, documentation, art, typesetting, graphics, printing, packaging, purchasing, and so on. It seems endless.

Programmers, most of whom will be working at home with their own computers, will be involved in a business which is estimated by 1990 to reach at least $4 billion per year in royalties.



The VIC, first shown here at the CES show in Las Vegas in January, and priced at $400, could just raise hell with the color computer market. It all depends on how serious Commodore is about supporting the system with advertising, software and accessories. It is, after all, the complete system that is important in the long run. Here I'm looking at the new VIC, with Commodore's English manager, Kit Spencer. Their Canadian rep is in the middle. Commodore has done particularly well in England, where, by the way, they have been advertising.

Then there will be a wide variety of database services which will have information for sale. Information of virtually any kind will be on tap—at a price. This will be the eventual solution to the information explosion. If you want to know where to get pictures of a bullet going through a light bulb, you'll be able to find the source quickly. If you want data on the speed of the bullet, you'll have that immediately available. There will be data —both historical and current—on all the firms in the stock market. Any information that will be needed will be available.

As more and more uses for computers are invented, we will have a growth in the number of accessories available. Many of these will be intelligent peripherals. For instance, a doctor might want a gadget to hook onto the finger of a patient to help his computer take the patient's history. This would measure the blood pressure, the temperature and the moisture of the finger as the questions are asked by the computer. This would, in essence, serve as a miniature lie detector to indicate any emotional responses. This is most helpful for doctors, for it helps them find the emotional content of most illnesses.

Lie detectors will find more and more use, so that may be a popular accessory—but it will be only one of hundreds. Each of these will provide an opportunity for a new small firm to be established, or for a big firm to get even bigger. Again, they'll need the whole range of supporting talent, like any other manufacturer.

Will each manufacturer be able to set up and run service centers all over the world, or will independent service organizations soon start growing to meet the need of businesses and schools for instant service or computers? Once a business gets a computer, everything stops when the computer stops, so service is going to be critical.

Most other fields have required reps to handle the interface between the manufacturers and the dealers. It just might be that micros will go the same route. Indeed, Instant Software set up their na-

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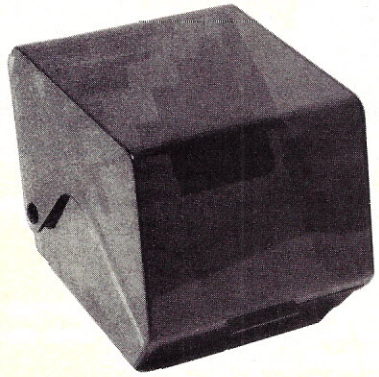
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tional rep organization over a year ago, one of the first in the business.

With equipment costs and interest rates being high, we may see a rapid growth of distributors. These firms can keep the inventory costs of dealers down, so they will be valuable. We'll need people for these firms, in all categories.

The new field is already requiring teachers, and many more will be needed. Dealers are setting up classes to teach programming and the use of the computers. We are likely to see a lot more of that. Then there is a need for teaching salesmen and other people in this new industry. We are running classes in business management at Instant Software and have upcoming classes in sales, service, etc.

The need for information is insatiable, so we'll be needing free-lance authors to write the articles and books to allow us to better use our systems. Publishers need the full range of talent—editors, artists, photographers, printers.

As you become acquainted with what is happening and what is expected ahead for microcomputing, you'll become aware of the need for more types of businesses.

No one knows how many dealers there will be, but they will probably number thousands. Each of these will need a wide range of talent. It is going to be a very large industry in five years.

If you put that at a personal level, this means that no matter what specialty you decide on, you are going to be in great demand. We already need people experienced in microcomputer advertising, but have virtually no one with that background. As firms become bigger and bigger, the ad budgets are going to escalate, too, and an ad consultant will be able to name his price.

This is no field for people without a lot of drive; there are just too many opportunities. The hard workers will be moving right along with this growth, going to the top.

$20,000 for an Article?

According to several of our authors, writing an article published in *Microcomputing* adds about $1000 per year in salary when they go on the job market. That should bring in at least $20,000 over a 20-year period. These published authors are recognized as "experts" in their fields. And, for those who want to eventually be established as consultants, a portfolio of published articles is a sure way to become accepted.

But this presents a dilemma for would-be consultants. They realize that it is a publish-or-perish world, yet they are reluctant to give their expertise away for the mere price of an article. The tendency is to guard knowledge and try to get top dollar for it. This seldom is profitable in the long run. The more successful consultants write as much as they can, knowing that they will always be able to keep ahead of those who are reading the small fraction of their knowledge which finds its way into print.



Another system which drew crowds was the HP-83. I even spotted top people from Apple and Tandy warily looking this one over.

What can you write about? Well, start with your field of expertise. We are also looking for articles, written in English, on your experiences with commercial products, software or hardware. There are thousands of businessmen who would like to know the details about a product you may have found of value.

Another interesting topic is a hardware/software/accessory combination which is working well for any specific type of business or profession. Unfortunately, much of the software being promoted is poor (at best), so objective evaluations of top-notch programs are needed.

On the hardware side, how about an article on interfacing the Casio M-10 electronic musical instrument so it can be used as a keyboard for computerized music? What about the Sharp Memowriter? That should interface to the Sharp pocket computer (1211), the same as the Radio Shack Pocket Computer. Let's see some work on hooking these and other gadgets into our systems.

Chrysler Strikes Again

Not all my ideas are good ones. One of the poorest ideas I've had was to get a van to be used as a portable office, so I could get some work done while traveling. We went to the Chrysler dealer in the next town and put $200 down on a Dodge van.

The delivery date came and went, and still nothing from the dealer, despite considerable pressure and promises. So we asked for the $200 deposit to be returned. Not only were we unable to get the deposit back, but when we contacted Chrysler about this dealer, they said they could do nothing to control their dealers. We eventually bought our Dodge van from another outfit in the same town.

After the first few hundred miles, a strange misery surfaced. I would get into the van, drive it about a half mile and it would stop. To get it going again required a team of mechanics to open up the engine (which is between the two front seats), take off the air filter and pour gas into the carburetor. There was a "little problem" with the automatic choke.

This trouble has stayed with me for three years, even after many visits to the Chrysler repair shops, the installation of a hand choke, the removal of the hand choke, and so on. Now they're putting in a hand choke again. How would you like to get into a van for a trip and wonder if it will run at every start during the trip?

So, from my viewpoint, not only has Chrysler been making gas guzzlers, it's also been making cars with engines which do not run dependably. I've seen some of the service bulletins on the problem, so I know that I am not at all alone with this monster. The van gets 12 miles to the gallon, but it makes up for it by having a 36-gallon tank.

Dictionary Needed

Several of the minicomputer word processors offer a built-in dictionary on a disk, and it is time for a similar service for micros. The program should be able to look up the words as they are being typed with the usual microcomputer word processor programs and then signal the operator when a word is misspelled. Then you need to have that dictionary on a disk.

If anyone decides to tackle this project, I think that one of the publishers can make it very popular. I know Instant Software is looking hard for this one.□

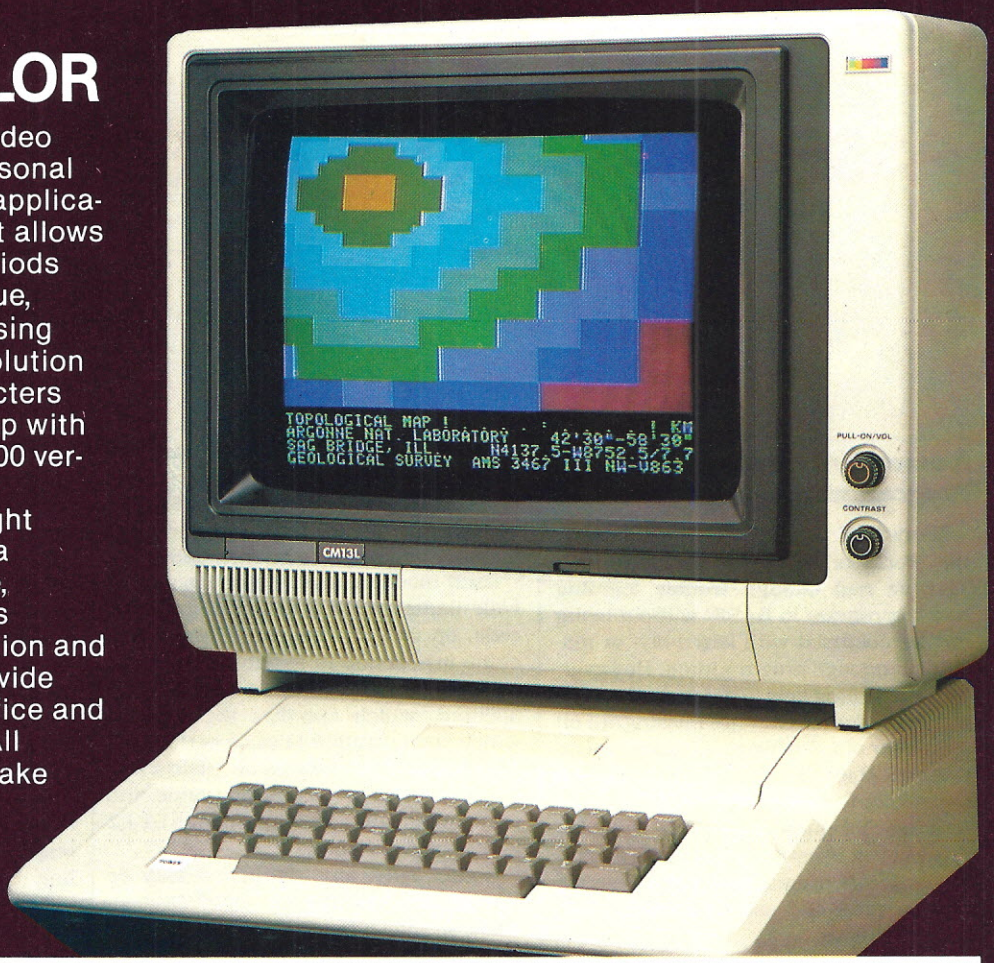
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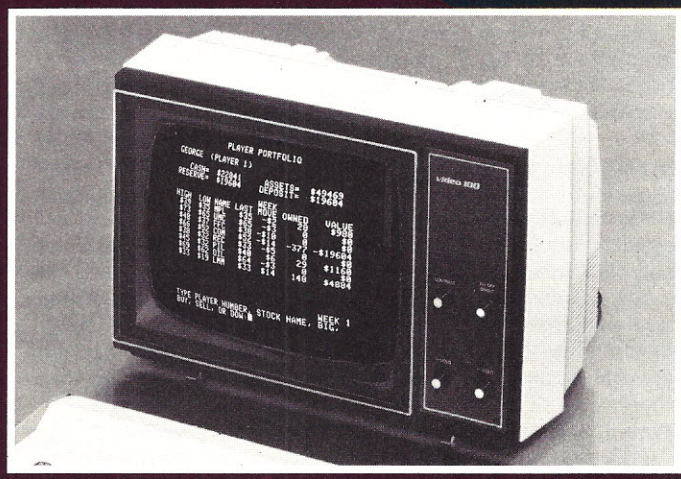
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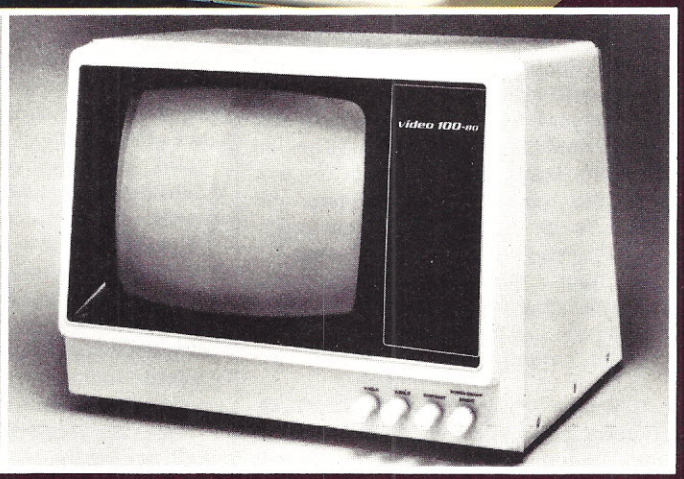
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By Robert W. Baker

Conversing in Assembly Language

Programming Tips for The 6502

Assembly-Language Programming

Many PET owners are newcomers to the world of computer programming. They've had enough trouble learning how to program in BASIC without being further confused with assembly- or machine-language programming. However, by not knowing how to use assembly-language programs, they are missing out on a number of valuable utilities and useful routines that are published in various magazines from time to time. After many requests, I thought it would be valuable to provide a basic introduction to assembly-language programming and describe how to enter and use an assembly-language program.

As most PET owners are aware, the PET is based on the 6502 microprocessor. The 6502 only understands ones and zeroes, corresponding to on or off states, so data and instructions are normally represented in binary notation. Users, on the other hand, find it difficult to work with the binary number system and therefore use a more convenient representation such as hexadecimal (base 16) or decimal. A typical 6502 instruction to load the value 21 (decimal) into the accumulator may be shown as:

```
10101001   00010101   in binary
  A9         15       in hexadecimal
```

Since most programmers find numeric representation of instructions tedious to work with, a symbolic representation is commonly used. For example, the preceding instruction might be written as:

```
LDA #21
```

In this case, LDA is the symbol for A9, load the accumulator.

A computer program called an assembler is used to translate the symbolic form LDA to the numeric form A9. The symbolic program is referred to as source code, and the numeric program generated by the assembler is called the object code. Some assemblers also produce a listing which shows the correlation between the source code and the object code. Only object code can be executed on the processor, but a special Loader program may be needed to get the object code generated by the assembler into memory and ready to be executed.

Each machine instruction has a symbolic name, referred to as an operation code, op code or mnemonic. Each machine instruction in assembly language consists of an op code, and possibly an operand, which specifies the data on which the operation is to be performed. The operand portion of an instruction specifies either an address or a value, and may contain an expression such as L2 + 2 for computed values.

Additionally, any instruction may be labeled for reference by other instructions, as shown by:

```
L2  LDA  #12
```

In this example, the label is L2, the op code is LDA, and the operand is #12. Labels are used on instructions as branch targets and on data elements for reference as operands.

Most assemblers also allow comments following the instruction operands. This provides a convenient way to document the program flow or logical operation for later reference. Assembler directives are another important feature of most assemblers. These are special instructions to the assembler to reserve storage space, generate data constants or otherwise control the assembler operation.

There are many different assemblers available for the PET at varying prices. Simple assemblers may assemble source code from BASIC DATA statements and POKE the object code directly into memory. Others may read the source code from tape or disk files and create an object file that must later be loaded by a special loader program (such as with the Commodore assembler).

Assemblers written in BASIC are inexpensive and relatively slow, but will usually run with any ROM set. Assemblers written in machine code run much faster and usually provide a number of features, but are more expensive and depend on a particular ROM set. Be aware of any limitations or requirements of an assembler before considering it for your particular environment.

Sample listing 1 shows an assembly listing for a very simple machine-language program. Let's disregard the actual function of the program for now and just look at the listing and what it tells us. The first column of four-digit numbers indicates the hexadecimal memory locations where every instruction or data constant is located. The next three columns of two-digit hexadecimal values indicate the object code, starting at the corresponding location indicated on that line.

The next column shows the source code line numbers. These are generally shown merely for convenience. They may, however, be used by a special editor for editing or creating the source code. The remainder of the line is the actual source code that was used to generate the object code shown on that line. There may also be comments on the source code line to document the program operation.

To get this program into your machine, if you have an assembler program, you might just type in the source code and assemble the program. At worst, you might have to convert the assembler syntax from that used in the article to the form used by your assembler.

However, if you don't have an assembler you can still enter and use the program. Just use the PET monitor program to enter the object code directly into the memory locations specified in the assembly. If the program is short (like Sample listing 1), entering the object code should be fairly simple; entering larger programs may not be a very pleasant task.

To enter the object code directly, first activate the PET monitor as outlined in the manuals. Usually you can do a SYS 1024 to get into the monitor. Then, display the memory area to be modified by using the monitor M xxxx,yyyy command. Here the xxxx value is the starting

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```
                0010            .LS
                0040 ;*********************
                0050 ;
                0060 ; SIMPLE SCREEN PRINT
                0070 ;
                0080 ;   BY: ROBERT BAKER
                0090 ;
                0100 ;*********************
                0110
                0120 LSTN       .DI $F0BA           ;CMND IEEE TO LSTN
                0130 IOUT       .DI $F128           ;IEEE OUT FRM REG(A)
                0140
                0150            .BA 900             ;USE TAPE #2 BUF
                0160
0384- A2 04     0170            LDX #$04            ;OPEN PRINTER
0386- 8E D4 00  0180            STX $D4
0389- 20 BA F0  0190            JSR LSTN
                0200
038C- A0 00     0210            LDY #0              ;SET FIRST SCREEN ADR
038E- A9 80     0220            LDA #$80
0390- 8D 98 03  0230            STA GET+2
0393- 8C 97 03  0240            STY GET+1
                0250
0396- B9 00 80  0260 GET        LDA $8000,Y         ;GET SCREEN CHR
0399- 29 7F     0270            AND #$7F            ;MASK OFF RVS BIT
039B- 18        0280            CLC
039C- 2C D0 03  0290            BIT BIT6            ;CONVERT TO ASCII
039F- F0 02     0300            BEQ ASC1
03A1- 69 40     0310            ADC #$40
03A3- 2C D1 03  0320 ASC1       BIT BIT5
03A6- D0 02     0330            BNE ASC2
03A8- 69 40     0340            ADC #$40
03AA- 20 28 F1  0350 ASC2       JSR IOUT            ;PRINT CHR
                0360
03AD- C8        0370            INY                 ;INC CHR CNT
03AE- C0 28     0380            CPY #40             ;DONE LINE ?
03B0- D0 E4     0390            BNE GET             ;NO, CONTINUE
03B2- A9 0D     0400            LDA #$0D            ;GET CARRIAGE-RETURN
03B4- 20 28 F1  0410            JSR IOUT            ;TO PRINTER
03B7- A9 0A     0420            LDA #$0A            ;AND LINE FEED
03B9- 20 28 F1  0430            JSR IOUT            ;TO PRINTER
03BC- 98        0440            TYA                 ;GET CHR CNT FOR LINE
03BD- 18        0450            CLC
03BE- 6D 97 03  0460            ADC GET+1           ;SET NEXT LINE ADR
03C1- 8D 97 03  0470            STA GET+1
03C4- 90 03     0480            BCC LNOK            ;SKIP IF NO CARRY
03C6- EE 98 03  0490            INC GET+2           ;ELSE INC HI-BYTE
03C9- A0 00     0500 LNOK       LDY #0              ;RESET CHR CNT
03CB- C9 E8     0510            CMP #$E8            ;FULL SCREEN?
03CD- D0 C7     0520            BNE GET             ;NO, KEEP GOING
03CF- 60        0530            RTS                 ;YES, STOP
                0540
03D0- 40        0550 BIT6       .BY $40             ;BIT CONSTANTS
03D1- 20        0560 BIT5       .BY $20
                0570            .EN
```

Sample listing 1. Simple screen print.

```
: 0384 A2 04 8E D4 00 20 BA F0
: 038C A0 00 A9 80 8D 98 03 8C
: 0394 97 03 B9 00 80 29 7F 18
: 039C 2C D0 03 F0 02 69 40 2C
: 03A4 D1 03 D0 02 69 40 20 28
: 03AC F1 C8 C0 28 D0 E4 A9 0D
: 03B4 20 28 F1 A9 0A 20 28 F1
: 03BC 98 18 6D 97 03 8D 97 03
: 03C4 90 03 EE 98 03 A0 00 C9
: 03CC E8 D0 C7 60 40 20 00 FF
```

Fig. 1. Memory display showing how the sample program was entered using the monitor.

hexadecimal address and yyyy is the ending hexadecimal address. You can get the hexadecimal addresses directly from the first column of the assembly listing.

If the program is long, choose a block of memory that will fit on the PET screen. Now enter the data in the appropriate locations, as indicated in the assembly listing. The data will normally be shown in hexadecimal in the listing, the form in which it will be accepted by the monitor. Just remember to hit return on each line to enter the data into memory. Fig. 1 is a memory display showing how the sample program was entered using the monitor.

When you've finished entering a machine-language program into memory, it's always a good idea to first save it on tape or disk before doing anything else. If you make a mistake in entering the program, it could cause the entire system to hang when the program is run. If this were to happen, you'd lose the program you just entered when you reset or powered-off the system to regain control.

The monitor command →S,"filename", dd,xxxx,yyyy can be used to save a copy on tape (dd = 01 or 02) or disk (dd = 08). You must specify the starting address (xxxx), and one plus the ending address (yyyy) of the area of memory to be saved.

There's one point that many PET owners are not aware of. You do not need to use the monitor to load a machine-language program that was saved on tape or disk. The normal BASIC load command will load either a BASIC or a machine-language program. Both are saved as a simple memory dump between two locations with the same file header.

Once you've saved a copy on tape or disk, try the program for proper operation. If you have a problem, reload the program and double-check the values entered using the monitor. Also, be sure the proper starting address was used to execute the program or routine. The normal starting address should be given in the article.

Occasionally, there may be alternate starting addresses for different functions or options. Also, some programs may expect parameters at specific locations set by the calling BASIC program or certain BASIC variables defined in a specific order. Be sure to read the article for specific details on how the program runs and what it expects.

Another way to double-check a machine-language program entered by the monitor is to use a disassembler, which is a simple program that converts object code back into symbolic assembler form. For those interested, a simple BASIC disassembler program is given in Sample listing 2. This program requests a starting address and then asks if printed output is desired. It then produces a disassembly starting from the location specified.

This program can also be helpful in looking at routines in the BASIC ROMs of the PET itself, if the appropriate starting address is given. I should warn, however, that if the starting address is not the first byte of an instruction (if it's actually an instruction operand), the output may be unpredictable. You may have to experiment with the starting address to get desirable results.

Sample listing 3 shows the disassembler output of Sample listing 2. As you can see, the disassembly is much like the assembly listing except there are no labels. All addresses are shown as absolute addresses, in hexadecimal notation. This disassembler provides the decimal as well as the hexadecimal location of each instruction for added convenience.

Also, on all branch instructions the actual target address, rather than the relative offset, is indicated. Thus, the disassembler can be used to verify that the correct instructions have been entered at the appropriate places.

Now let's take a look at the actual machine-language program given in Sample listing 1. The program was assembled using the MAE assembler from Eastern House Software that I reviewed in the August 1980 issue of *Kilobaud Microcomputing* (p. 20). This program provides a simple routine to print the contents of the PET screen on the printer.

For convenience, it assumes the PET is in the uppercase/graphics mode with a 40-column display. It converts all reverse image characters to normal image (masking off bit 7) to avoid sending the printer

```
900 0384: A2 04     LDX #$04
902 0386: 8E D4 00  STX $00D4
905 0389: 20 BA F0  JSR $F0BA
908 038C: A0 00     LDY #$00
910 038E: A9 80     LDA #$80
912 0390: 8D 98 03  STA $0398
915 0393: 8C 97 03  STY $0397
918 0396: B9 00 80  LDA $8000,Y
921 0399: 29 7F     AND #$7F
923 039B: 18        CLC
924 039C: 2C D0 03  BIT $03D0
927 039F: F0 02     BEQ $03A3
929 03A1: 69 40     ADC #$40
931 03A3: 2C D1 03  BIT $03D1
934 03A6: D0 02     BNE $03AA
936 03A8: 69 40     ADC #$40
938 03AA: 20 28 F1  JSR $F128
941 03AD: C8        INY
942 03AE: C0 28     CPY #$28
944 03B0: D0 E4     BNE $0396
946 03B2: A9 0D     LDA #$0D
948 03B4: 20 28 F1  JSR $F128
951 03B7: A9 0A     LDA #$0A
953 03B9: 20 28 F1  JSR $F128
956 03BC: 98        TYA
957 03BD: 18        CLC
958 03BE: 6D 97 03  ADC $0397
961 03C1: 8D 97 03  STA $0397
964 03C4: 90 03     BCC $03C9
966 03C6: EE 98 03  INC $0398
969 03C9: A0 00     LDY #$00
971 03CB: C9 E8     CMP #$E8
973 03CD: D0 C7     BNE $0396
975 03CF: 60        RTS
976 03D0: 40        RTI
977 03D1: 20 00 FF  JSR $FF00
```

Sample listing 3. Disassembler output of the program of Sample listing 1.

controls for turning reverse image on and off. Since the screen values are not the same values that must be sent to the printer, each character must be translated before being printed.

The program uses two routines from the BASIC ROMs, and was written for BASIC 3.0. The routine at $F0BA (LSTN) commands the IEEE device to listen. The routine at $F128 (IOUT) outputs a character from the 6502 accumulator to the IEEE device. These addresses are defined symbolically in lines 0120 and 0130 in the assembly listing. The method used to communicate with the printer may not be the preferred way to use the IEEE device, but it's simple and it works.

The program resides in the second cassette buffer, starting at location 900 decimal. This is indicated in the assembly listing line 0150, where the assembler directive .BA is used to specify the beginning address. To execute the machine-language routine, simply execute the SYS 900 command. Whatever is currently on the screen will be printed on the printer.

At the end of the program are two data constants in locations $03D0 and $03D1. The assembler .BY directive is used in lines 0550–0560 to create single-byte data constants. These constants are used for converting the screen values to ASCII for the printer. The actual conversion is done in lines 0270–0340 of the source code. The conversion consists of adding $40 to the character code if bit 6 is set (1), and/or $40 if bit 5 is clear (0).

```
 10 REM ******************************
 20 REM
 30 REM MACHINE LANGUAGE DIS-ASSEMBLER
 40 REM
 50 REM        BY: ROBERT BAKER
 60 REM
 70 REM ******************************
 80 :::
 90 PRINT"■■      D I S  -  A S S E M B L E R       "
100 PRINT"■■■INITIALIZING ....
110 DIM M$(255):  H$="0123456789ABCDEF"
120 FOR X=0 TO 255: READ A$: IF A$="*" THEN A$="0*?*"
130 A$=LEFT$(A$+"      .",6): M$(X)=A$: NEXT X
140 PRINT"■ENTER DECIMAL STARTING ADDRESS■
150 PRINT"OR HEX ADDRESS PRECEDED BY '$'■
160 INPUT A$: IF LEFT$(A$,1)="$" THEN 190
170 FOR X=1 TO LEN(A$): C$=MID$(A$,X,1): IF C$ < "0" OR C$ > "9" THEN 140
180 NEXT X: A=INT(VAL(A$)/8)*8: GOTO 250
190 A=0: IF LEN(A$)<2 THEN 140
200 FOR X=2 TO LEN(A$): C$=MID$(A$,X,1): IF C$ < "0" THEN 140
210 IF C$<="9" THEN A=A*16+VAL(C$): GOTO 240
220 IF C$<"A" OR C$>"F" THEN 140
230 A=A*16+ASC(C$)-55
240 NEXT X
250 INPUT"■WANT PRINTED COPY (Y/N)   N■■■";C$
260 P=3:IF LEFT$(C$,1)="Y" THEN P=4
270 OPEN 4,P
280 PRINT"■";: IF P=3 THEN 300
290 PRINT"DEPRESS ANY KEY TO HALT PRINTER":PRINT#4
300 PRINT#4,"■ LOC-DEC/HEX   OBJECT    DISSASSEMBLY  ": PRINT#4
310 IF P=3 THEN FOR N=1 TO 20
320 IF A>65536 THEN A=A-65536
330 A$=STR$(A): L=LEN(A$): PRINT#4,SPC(7-L);A$;" ";
340 Y=A:GOSUB 620: PRINT#4,": ";
350 V=PEEK(A): GOSUB 630: PRINT#4," ";:  A=A+1:  A$=M$(V)
360 IF LEFT$(A$,1)="0" THEN PRINT#4,SPC(7);MID$(A$,2,3): GOTO 540
370 V=PEEK(A): GOSUB 630: PRINT#4," ";: A=A+1
380 IF LEFT$(A$,1)="2" THEN 470
390 PRINT#4,SPC(4);MID$(A$,2,3);" ";: IF MID$(A$,5,1)<>"R" THEN 420
400 IF V>127 THEN V=V-256
410 Y=A+V: GOSUB 610: GOTO 530
420 IF MID$(A$,5,1)="#" THEN PRINT#4,"#$";: GOSUB 630: GOTO 530
430 IF MID$(A$,6,1)=")" THEN PRINT#4,"(";
440 PRINT#4,"$";: GOSUB 630: IF MID$(A$,5,1)=" " THEN 530
450 IF MID$(A$,5,2)="Y)" THEN PRINT#4,"),Y": GOTO 540
460 PRINT#4,",";MID$(A$,5,2): GOTO 540
470 V1=V: V=PEEK(A): GOSUB 630: A=A+1: PRINT#4,"  ";MID$(A$,2,3);" ";
480 Y=V1+(256*V)
490 IF MID$(A$,5,1)=")" THEN PRINT#4,"(";: GOSUB 610: PRINT#4,")": GOTO 540
500 GOSUB 610
510 IF MID$(A$,5,1)=" " THEN 530
520 PRINT#4,",";MID$(A$,5,1);
530 PRINT#4
540 IF P=3 THEN NEXT N: GOTO 560
550 GET C$: IF C$="" THEN 320
560 PRINT"■■CONTINUE, RESTART, OR STOP (C,R,S) ?  ";
570 GET C$: IF C$="C" THEN 280
580 IF C$="R" THEN CLOSE 4: GOTO 140
590 IF C$<>"S" THEN 570
600 PRINT#4: CLOSE 4: END
610 PRINT#4,"$";
620 V=INT(V/256): GOSUB 630: V=V-(V*256)
630 H=INT(V/16): L=V-(H*16)
640 PRINT#4,MID$(H$,H+1,1);MID$(H$,L+1,1);:  RETURN
650 DATA 0BRK,1ORAX),*,*,*,1ORA,1ASL,*
660 DATA 0PHP,1ORA#,0ASL,*,*,2ORA,2ASL,*
670 DATA 1BPLR,1ORAY),*,*,*,1ORAY,1ASLX,*
680 DATA 0CLC,2ORAY,*,*,*,2ORAX,2ASLX,*
690 DATA 2JSR,1ANDX),*,*,1BIT,1AND,1ROL,*
700 DATA 0PLP,1AND#,0ROL,*,2BIT,2AND,2ROL,*
710 DATA 1BMIR,1ANDY),*,*,*,1ANDX,1ROLX,*
720 DATA 0SEC,2ANDY,*,*,*,2ANDX,2ROLX,*
730 DATA 0RTI,1EORX),*,*,*,1EOR,1LSR,*
740 DATA 0PHA,1EOR#,0LSR,*,2JMP,2EOR,2LSR,*
750 DATA 1BVCR,1EORY),*,*,*,1EORX,1LSRX,*
760 DATA 0CLI,2EORY,*,*,*,2EORX,2LSRX,*
770 DATA 0RTS,1ADCX),*,*,*,1ADC,1ROR,*
780 DATA 0PLA,1ADC#,0ROR,*,2JMP),2ADC,2ROR,*
790 DATA 1BVSR,1ADCY),*,*,*,1ADCX,1RORX,*
800 DATA 0SEI,2ADCY,*,*,*,2ADCX,2RORX,*
810 DATA *,1STAX),*,*,1STY,1STA,1STX,*
820 DATA 0DEY,*,0TXA,*,2STY,2STA,2STX,0
830 DATA 1BCCR,1STAY),*,*,1STYX,1STAX,1STXY,*
840 DATA 0TYA,2STAY,0TXS,*,*,2STAX,*,*
850 DATA 1LDY*,1LDAX),1LDX#,*,1LDY,1LDA,1LDX,*
860 DATA 0TAY,1LDA#,0TAX,*,2LDY,2LDA,2LDX,*
870 DATA 1BCSR,1LDAY),*,*,1LDYX,1LDAX,1LDXY,*
880 DATA 0CLV,2LDAY,0TSX,*,2LDYX,2LDAX,2LDXY,*
890 DATA 1CPY#,1CMPX),*,*,1CPY,1CMP,1DEC,*
900 DATA 0INY,1CMP#,0DEX,*,2CPY,2CMP,2DEC,*
910 DATA 1BNER,1CMPY),*,*,*,1CMPX,1DECX,*
920 DATA 0CLD,2CMPY,*,*,*,2CMPX,2DECX,*
930 DATA 1CPX#,1SBCX),*,*,1CPX,1SBC,1INC,*
940 DATA 0INX,1SBC#,0NOP,*,2CPX,2SBC,2INC,*
950 DATA 1BEQR,1SBCY),*,*,*,1SBCX,1INCX,*
960 DATA 0SED,2SBCY,*,*,*,2SBCX,2INCX,*
READY.
```

Sample listing 2. Machine-language disassembler.

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Starwriter

If you've been waiting for a reasonably-priced letter-quality printer, take a good look at C. Itoh's Starwriter. It's a 25-character-per-second daisywheel printer for under $1900, list. Current retail prices even range as low as $1500! The printer is available with either parallel or serial interfaces, but the serial interface seems to be the most commonly found. Either version requires an IEEE interface adaptor to connect to the PET, but an RS-232 adaptor appears to be cheaper and easier to find. The printer will run at 2400 baud with the CmC ADA-1450 interface. (A 45 cps Starwriter version is also available at a higher price.)

The printer uses a standard Diablo plastic print wheel and Diablo HyType II cartridge ribbons. You can use paper up to 15 inches wide, with 136 (pica) or 163 (elite) characters per line. The printers are normally friction-feed, but tractor-feed and pin-feed options are available.

Several internal DIP switches on the serial model select various options for the 8085 microprocessor controlling the printer:

- Serial baud rate 300 to 2400 baud
- Even, odd or no parity
- Seven or eight data bits
- One or two stop bits
- Auto line feed on or off

The printer can operate in one of two modes: serial or line mode. In line mode the printer provides bidirectional printing and a programmable vertical format unit (VFU). In serial mode, the printer only prints in one direction but a number of escape codes are available for:

- Half-line feed up or down
- Proportional spacing
- Horizontal and vertical tabs

Also, backspacing is only supported in serial mode.

If you're using Word Pro 3 or 4 on the PET, there is a simple patch available from various dealers to make the Starwriter work just like the NEC Spinwriter. This gives you semi-proportional spacing, underlining and excellent print quality. Word Pro will use the proportional spacing features of the Starwriter to insert extra space between words on a line to justify the right margin.

The only drawback to using the Starwriter is that the printer must provide an automatic linefeed after carriage returns to work with Word Pro. If you print listings or regular program output, you'll have to defeat the auto linefeed or else live with double spacing. Of course, it goes without saying that the Starwriter will not print the PET graphics, so it's still nice to have the Commodore printer for listings.

After heavily using a Starwriter for several weeks, I am impressed with its quality, performance and dependability. The 25 characters-per-second printer is not the fastest printer around, but it suits my application just perfectly. With this kind of quality, who cares if it takes a few more minutes to print an article? I still use my Commodore printer for program listings and general work, but I do my important work on the Starwriter.

Miscellany

I just learned from a reader in Texas that VisiCalc does not support non-Commodore printers for printed output. He was told by Personal Software, however, that there would be a fix coming around the third quarter of 1981 (under warranty). Hopefully, they will get to it sooner, especially if Commodore comes out with a new printer for the PET/CBM line.

The MAE User Group (November 1980 column) is no longer charging a fee to copy programs. Simply send a diskette, a suitable mailer and sufficient return postage. As part of their new policy, programs on cassette and program listings are no longer available. By the way, several programs were recently dropped from their exchange, and the original disks have been reorganized. For more information on the exchange, write James Strasma, c/o Grace UMC, 120 West King St., Decatur, IL 62521.

The foreign-language-character-generator ROMs that I mentioned in the December 1980 column are really only one ROM. West River Electronics, producers of the chips, pointed out my mistake and mentioned that the ROM is now only $60. After trying both the foreign-language and math-character-generator ROMs, I must say they are very nice and could be valuable for schools. For more information, write West River Electronics, PO Box 605, Stony Brook, NY 11790.

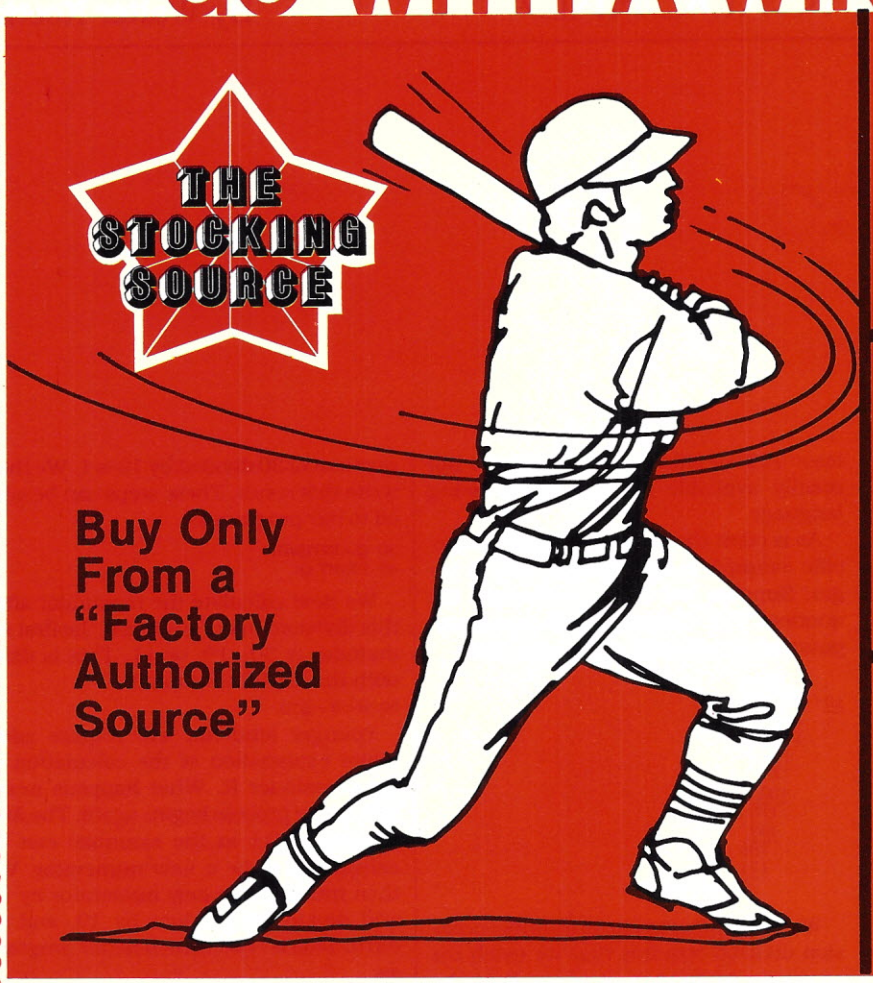
I recently received another assembler program for review, and thought I should at least mention it here. This assembler package is written in machine language but uses cassette tape to load and save source files. The program contains both an editor and an assembler in one package, and will run on any 16K or 32K PET with BASIC 3.0 ROMs.

The editor is elaborate and takes a while to get used to. The assembler is fast and rather good. Unfortunately, no price was mentioned in the material I received, so it's hard to compare against the assemblers currently available here.

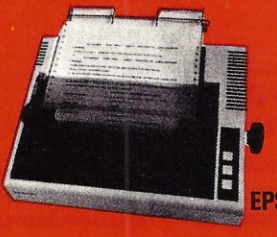
If you're interested in more information, you can write Ing W. Hofacker, Fachbuchverlag Elektronic, 8 Munchen 75, Postfach 437 West Germany. For your information, this is the same group that produced the Monjana monitor ROM that is being sold here in the US by Elcomp Publishing in Chino, CA. However, as far as I know Elcomp is not carrying the assembler program.□

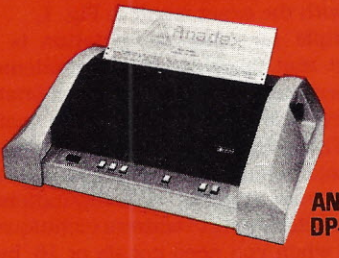
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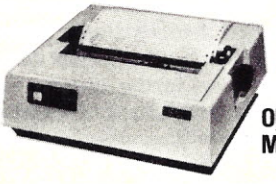



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By Walter Koetke

Multi-digit Microcomputing

Programming As Easy as 1, 2, 3, . . .

Multiple Precision Arithmetic

Can you calculate the exact value of 3^{1690}? Sure you can—if you're willing to make an unreasonably large investment of time. After all, 3^{1690} is just the product of 1690 threes. When you've finished with your computation, check your results with the exact result in Fig. 1.

Multiple precision computation is a subject that fascinates many students, and certainly one that is appropriate whenever computing facilities are available. The versions of BASIC available on most microcomputers are quite accurate for the vast majority of computations. This article begins to address techniques useful when you need not six or 16, but hundreds of significant digits.

Let's begin with long division. This sequence can be introduced in the fourth grade. How many of the ideas should be introduced is a function of the students' interest and experience. I recently initiated the sequence with a group of sixth graders who extended the ideas well beyond the scope of this article.

Consider the simple problem of dividing one integer by another (N/D). The simple BASIC command PRINT N/D or something quite similar will print the quotient containing the maximum number of significant digits available on your microcomputer. However, if we want at least 100 significant digits, they're not readily available in any programming language.

As is often the case, considering a specific example is an excellent way to begin. Suppose we wish to calculate the quotient 3/19. Our pencil and paper computation should look something like:

```
      .15789
19 / 3.0
     1 9
     1 10
       95
       150
       133
        170
        152
         180
         171
           9  and so forth
```

Writing a program to do multiple precision division requires that we teach the computer to divide just as we divide by hand. Suppose the division to be completed is expressed as the fraction N/D. Suppose also that the numerator (N) is always less than the denominator (D).

The first step in our pencil and paper division was to add a zero after the numerator. Because multiplying by 10 has the effect of adding a zero to any integer, we can begin our program as:

```
10 INPUT N, D
20 N=N*10
```

We now determine by hand the integral quotient when the modified numerator is divided by the denominator. In the example, we determine that the integral quotient of 30 divided by 19 is 1. We then write this result. These steps can be added to our program as:

```
30 Q=INT(N/D)
40 PRINT Q;
```

We next calculate the remainder after this division. In our example, the first remainder is 30 – 19, or 11. This is done with the BASIC command

```
50 R=N-Q*D
```

Younger students will require additional explanation of the calculation of the remainder R. What happens next? The entire process begins again. The first remainder (11 in the example) can be considered to be a new numerator. We then multiply the new numerator by 10 and divide the product by 19, and so forth. This is represented in our program as:

```
60 N=R
70 GOTO 20
```

Be sure that students fully understand the meaning of these two lines. Realizing that the division process is just the continued repetition of the process represented in statements 20 through 60 is the key to understanding multiple precision division.

Listing 1 contains the program we just developed for multiple precision division and one run of that program. A few cosmetic statements have been added, but the division algorithm is unchanged.

Even young students using this program are not satisfied when the output becomes a repeated sequence of zeroes, which occurs for all terminating decimals. Enter the program and try a few examples. The program in Listing 1 should be valid using any vendor's version of BASIC.

Adding a command to terminate the program as soon as the decimal terminates is very easy, if students understand the division algorithm. Quite simply, we wish to terminate the program in Listing 1 whenever the remainder (R) is zero.

```
  1690
3      = 216232254405589155931587597878243365246126024970456383134527726478553180216402814212344804139242905873126878594497454291618240591714754223919985547889613322010803681803367441735913887462619623646347142459448510180110210991625684593649057222139338258942840505579267012995830677951463242161981274108716442439554527134675975439635249282233051493653186244711594666812427176361029843012107818298963089640087571021559642813003891640339590934005356340939718612965118765236270103805678147103407438210906709846663237799028110885274899260493865135882329363817754439902382700539582525262835573912684807629566951419618472949468706601034933344883083625667416925234613663069638384513595351161345063493359737359106482033575396987609695677876285577496155998682103831354701791585542168493743847721931016958237317760130089449
```

Fig. 1.

Walter Koetke, Putnam/North Westchester BOCES, Yorktown Heights, NY 10598.

This is done by adding the single command

```
55 IF R=0 THEN END
```

Some students will incorrectly terminate the program whenever the quotient (Q) is zero. Helping these students understand why this answer is incorrect is very important.

The next improvement desired by most students is to terminate the program whenever a repeating decimal begins to repeat. After all, typing .3 to represent 1/3 or .142857 to represent 1/7 is certainly sufficient, if not more desirable. Asking students to do this is an excellent exercise, as the correct answer certainly reflects an understanding of the division process. Before asking, however, restrict the problem to the single case in which the entire decimal portion is repeated. Don't worry about cases such as 1/12 (1/12 = .083333 . . .), in which the repeating decimal portion does not repeat the first two digits. One modification of our program that will provide this additional capability is:

```
11 S=N
56 IF S=R THEN PRINT "     R"  : END
```

Notice that "R" is printed when a repeating decimal terminates. This is needed to distinguish repeating decimals from terminating decimals.

Students must understand the use of subscripts if they wish to pursue this program any further. The next likely improvement is to have the program terminate after a full cycle of any repeating decimal has been printed. Subscripts are necessary, as each remainder must be compared to every preceding remainder rather than just to the original numerator. The program given in Listing 2 uses subscripts in this manner.

Although this is a relatively simple program, creative mathematics teachers can use the idea represented to explore many challenging questions. For example, consider the fraction 1/D. Which values of D will have D – 1 digits in their repeating cycle? Is there a pattern or method for predicting whether a given D will result in: a terminating decimal; a repeating decimal containing D – 1 digits; or a decimal with both a repeating and a nonrepeating portion?

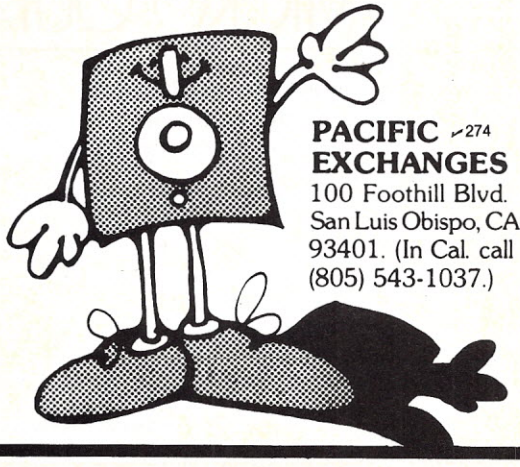
```
5  PRINT "ENTER NUMERATOR (N) AND DENOMINATOR (D) WITH N < D"
10 INPUT N, D
12 IF N >= D THEN 5
17 PRINT " . ";
20 N=N*10
30 Q=INT(N/D)
40 PRINT Q;
50 R=N-Q*D
60 N=R
70 GOTO 20


 RUN
ENTER NUMERATOR (N) AND DENOMINATOR (D) WITH N < D
? 3, 19
 .  1  5  7  8  9  4  7  3  6  8  4  2  1  0  5  2  6  3  1  5
 7  8  9  4  7  3  6  8  4  2  1  0  5  2  6  3  1  5  7  8  9
 4  7  3  6  8  4  2  1  0  5  2  6  3  1  5  7  8  9  4  7  3
 6  8  4  2  1  0  5  2  6  3  1  5  7  8  9  4  7  3  6  8  4
 2  1  0  5  2  6  3  1  5  7  8  9  4  7  3  6  8  4  2  1  0
 5  2  6  3  1  5  7  8  9  4  7  3  6  8  4  2  1  0  5  2  6
 3  1  5  7  8  9  4  7  3  6  8  4  2  1  0  5  2  6  3  1  5
 7  8  9  4  7  3  6  8  4  2  1  0  5  2  6  3  1  5  7  8  9
 4  7  3  6  8  4  2  1  0  5  2  6  3  1  5  7  8  9  4  7  3
 6  8  4  2
READY
```

Listing 1. Division program and sample run.

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The topic of multiple precision integer multiplication will prod the imagination of many students. To implement the required algorithms in BASIC requires subscripts, but don't let that make you hesitate to use this topic with elementary school students. With a brief introduction involving a few easy examples, the younger students can handle subscripts quite well.

We'll begin our exploration of multiple precision multiplication with an easily defined and managed problem. Let's multiply an N-digit integer by a single digit. Consider the specific example:

$$\begin{array}{r} 517 \\ \times\ 4 \\ \hline 2068 \end{array}$$

Although this example doesn't require any additional precision, it does require all of the concepts needed to implement a multiple precision algorithm. One method for representing the problem is to use one subscripted variable to represent each digit of the multi-digit number and another subscripted variable to represent each digit of the product. While this representation is far from a model of efficient memory use, the model is easy to understand and quite effective for about 7000 digits on a 16K microcomputer.

The first step in the program is to provide a means for entering an N-digit number. One of the simplest procedures is to use BASIC's READ/DATA commands. Therefore, the first lines of our multiple precision multiplication program are:

```
10 DATA 3          the number of digits in the N-digit
                   number
20 DATA 5, 1, 7    the N-digit number itself
30 DATA 4          the single digit multiplier
40 READ N
50 DIM D (N)
60 FOR I=N to 1 STEP -1
70 READ D(I)
80 NEXT I
90 READ M
```

Because we've agreed that the product will also be represented by a subscripted variable, that variable must also be dimensioned. Therefore, we'll rewrite line 50 to read

```
50 DIM D(N), A(N+1)
```

Now we can proceed to represent our algorithm for pencil and paper multiplication in BASIC. The first step is to compute the product of the right-most digit and the multiplier. The second step is to determine how much of this product is "carried" to the next position. Step three is to write the units position on the paper. The same process is then repeated in a right-to-left manner for each position of the N-digit number. The only exception is that each new product must be increased by the previous carry. If we define a start-up carry of 0, then we can represent all products including the first as being increased by the carry. The BASIC form of this algorithm is:

```
100 C=0
110 FOR I=1 TO N
120 P=D(I)*M+C
130 C=INT (P/10)
140 A(I)=P-C*10
150 NEXT I
160 A(N+1)=C
```

All that remains is to print the final product. We can, however, make a major improvement. Notice that once we calculate the ith position of the product, we no longer need the ith position of the N-digit number. By using the same variable to represent the product as we use to represent the N-digit number, we reduce the amount of memory used by almost one-half. While saving space is not an important factor with this example, it often can be with more significant multiple precision programs. The space can be saved by reentering the following lines:

```
 50 DIM D(N+1)
140 D(I)=P-C*10
160 D(N+1)=C
```

Now we'll complete the last step of printing the final product:

```
170 PRINT "THE PRODUCT IS:"
180 IF C>0 THEN N=N+1
190 FOR I=N to 1 STEP -1
200 PRINT D(I);
210 NEXT I
```

Enter this program. Be sure you understand each of the steps. The concepts are not difficult. If programming is relatively new to you, the statements may appear tedious. Rest assured, however, that this program is quite manageable by seventh grade students as well as many younger ones.

In fact, the exact value of 3^{1690} illustrated in Fig. 1 was produced by a program written by a twelve-year-old, who wrote this shortly after "discovering" the techniques presented in the preceding program. Next month we'll examine his work. We'll also look at a program for computing the exact value of large factorials. If you've always wanted to see the exact value of 999!, don't miss next month's column!□

```
10 DIM R(3000)
20 PRINT "ENTER NUMERATOR (N) AND DENOMINATOR (D) WITH N < D"
30 INPUT N, D
40 P=0
50 R(0)=N
60 PRINT " . ";
70 N=N*10
80 Q=INT(N/D)
90 PRINT Q;
100 P=P+1
110 R(P)=N-Q*D
120 IF R(P)=0 THEN C=P : GOTO 180
130 FOR C=0 TO P-1
140   IF R(C)=R(P) THEN 180
150 NEXT C
160 N=R(P)
170 GOTO 70
180 PRINT
190 PRINT C    "NON-REPEATING DIGITS"
200 PRINT P-C "REPEATING DIGITS"


RUN
ENTER NUMERATOR (N) AND DENOMINATOR (D) WITH N < D
? 3, 19
 .  1  5  7  8  9  4  7  3  6  8  4  2  1  0  5  2  6  3
 0 NON-REPEATING DIGITS
 18 REPEATING DIGITS
READY
>

RUN
ENTER NUMERATOR (N) AND DENOMINATOR (D) WITH N < D
? 124, 512
 .  2  4  2  1  8  7  5
 7 NON-REPEATING DIGITS
 0 REPEATING DIGITS
READY
>

RUN
ENTER NUMERATOR (N) AND DENOMINATOR (D) WITH N < D
? 1, 12
 .  0  8  3
 2 NON-REPEATING DIGITS
 1 REPEATING DIGITS
READY
>
```

Listing 2.

MICRO QUIZ

Analysis of Algorithms

During the execution of this program, how many different elements of A are accessed?

```
10 DATA 5, 10, 4, 10, 4, -10, 8, 9, -5,
   -9
20 READ X
30 IF X<0 THEN GOTO 70
40 A(X)=X*X
50 READ X
60 GOTO 20
70 STOP
```

Answer on page 243.

4 ALL NEW GUIDES

from OSBORNE/McGraw-Hill

✓149

The Apple II User's Guide by Lon Poole, Martin McNiff, and Steven Cook #46-2, $15. ☐

This Guide is the key to unlocking the full power of your Apple II or Apple II plus computer. The Apple II User's Guide brings together in one place a wealth of information for Apple computer users. It will tell you more about your Apple than any other single source. This book will save you both time and effort. No longer will you have to search endlessly for useful information. It's all here, in the Apple II User's Guide, thoughtfully organized and easy to use. Topics include:

*Applesoft and Integer BASIC programming - especially how to make the best use of Apple's sound, color and graphics capabilities. The book presents a thorough description of every BASIC statement, command and function.

*Advanced programming - special sections describe High Resolution graphics techniques and other advanced applications.

*Hardware features - the disk drive and printer are covered in separate chapters.

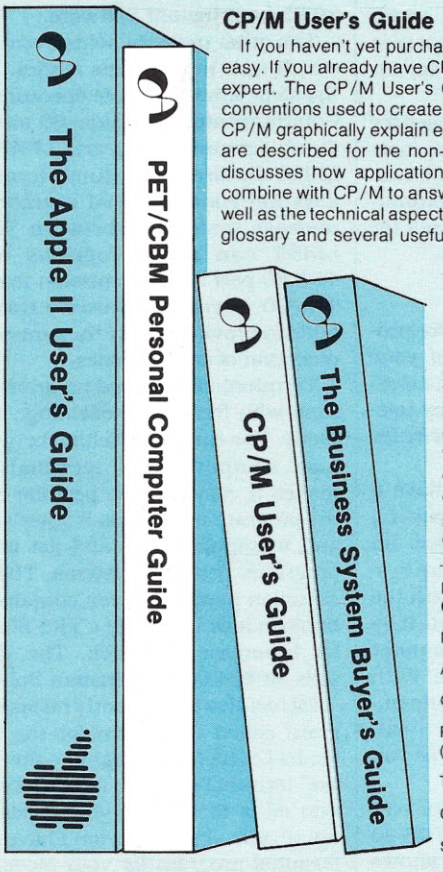
*Machine level programming - although not a machine language programming guide, this book covers the Machine Language Monitor in detail.

*Apple is a trademark of the Apple Computer Corporation.

PET/CBM Personal Computer Guide *Second Edition* by Adam Osborne and Carroll Donahue #55-1, $15. ☐

The *PET/CBM Personal Computer Guide* is a step-by-step guide that assumes no prior knowledge of computers. If you can read English, you can use this book. This revised second edition provides even more useful material than the popular first edition. It covers the most recent CBM products: the CBM 8000 and 4000 series computers, the 2040 and 8050 disk drives, and programmable printers. Adam Osborne co-authored this new edition. He has re-written it to be a step-by-step BASIC tutorial. So if you don't know BASIC, don't worry. This book will teach you both BASIC and CBM BASIC. If you're thinking about buying any personal computer, this book will show you what the PET can do for you. If you've just bought a PET or CBM, this is the book you must have to really understand your computer. By using the examples found in this book you'll quickly get your PET/CBM up and running. These examples are thoroughly documented so you can learn how and why the programs work. It's the "how" and "why" that are important in learning to make the PET work efficiently for you. The PET Personal Computer Guide covers everything you'll need to be master of your PET.

*PET and CBM are both trademarks of Commodore Business Machines.



CP/M User's Guide by Thom Hogan #44-6 $12.99 ☐

If you haven't yet purchased CP/M for your system, the CP/M User's Guide will make your first use of CP/M easy. If you already have CP/M, this book will help you modify your system and let you "jockey your disks" like an expert. The CP/M User's Guide describes types of CP/M and their compatibility. It includes a discussion of conventions used to create file names and command lines. Numerous sample screen displays for each version of CP/M graphically explain each operator command and computer response. CP/M's Assembly Language Utilities are described for the non-technical reader who wants maximum use of CP/M's capabilities. The book also discusses how application packages, high level languages, solution programs, and other support programs combine with CP/M to answer a user's individual needs. You'll also find an explanation of MP/M and CP/NET as well as the technical aspects of CP/M's internal structure which will permit you to make simple modifications. A full glossary and several useful appendices are included.

*CP/M is a trademark of Digital Research Corporation.

The Business System Buyer's Guide by Adam Osborne #47-0 $7.95 ☐

When you enter the marketplace of small business computers you face a bewildering array of products, prices, features, and fables. This guide cuts through the jargon and unravels the task of buying the right computer system. Dr. Osborne is the foremost authority on the use of computers in small businesses. Here, he helps you to analyze your computer needs by applying the same know-how that made your business a success. This book provides solid information on how to determine your needs, how to choose software and hardware for all business applications, what to expect from vendors, what to avoid, and what questions you must ask. It also provides a wealth of detailed information on products, manufacturers, retailers, and the whole microcomputer marketplace. Purchasing a computer system for any business is a complex process, but it need not be a frustrating one. This book will help. Before you buy any computer, read this book. You'll never make a better investment.

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By Frank J. Derfler, Jr.

TRS-80 Terminal Programs

Support from Radio Shack And ISI

Come on in! I was just going through my mail. Stay for a few minutes and we'll see what's new in the world of data communications. I have several programs to tell you about and some interesting mail to catch up on.

TRS-80 Comm

Here on top of the stack, I have four programs for TRS-80 data communications —two from Radio Shack and two from Instant Software, Inc.

The Radio Shack Videotex programs make the TRS-80 Model I/III and the Color Computer into terminals designed for smooth interface with the CompuServe information utility.

The Model I/III Vidtex (catalog 26-2220) is a machine-language program which can work from disk or tape. It requires a 16K Level II system with communications hardware. For the Model I, that means an expansion interface, RS-232C card and modem (or a Lynx or Termcom). The Model III needs the RS-232C card and a modem. The program will support the lowercase modification if it has been installed. It has its own keyboard decoder, which allows the transmission of control codes, and special characters such as the square brackets.

The Color Computer comes with an RS-232C port installed. A 4K system can load and run the terminal software. The Videotex program for the Color Computer (catalog 26-2222) provides a little more operating flexibility than the Model I version in that messages can be prepared off line for later transmission. This feature saves money because the message is transmitted faster than it can be typed, lowering system-use time and long-distance phone bills.

The off-line message preparation system includes a character editing capability. The maximum length of the message depends on the amount of memory in the computer. A 4K system can hold three pages of data. Lowercase characters can be transmitted, but not displayed.

Both Videotex packages come with a CompuServe user identification number and one hour of paid service. You must establish a CompuServe account (application included) to use more than that hour.

Both programs recognize the control codes transmitted by CompuServe to clear the screen, change screen width and position the cursor. This allows nice formatting of the material on the screen for easy reading.

The Videotex programs can be used for communications with all electronic message systems and information utilities. They provide a well-integrated communications system. The programs sell for $29.95.

Instant Software

Instant Software's Communicator program allows remote operation of your TRS-80 through the serial port. The remote terminal can be connected by telephone and a modem or simply by wire for local use.

As an example, suppose you have a multidisk TRS-80 system worth several thousands of dollars in your office. Instead of trying to recreate the entire system at home, you could leave it with the Communicator running and operate it by telephone using a $400 Color Computer and modem as a terminal at home. With an additional bit of software, an auto-answering modem would provide unattended operation. (Handy, as long as you don't have to change disks.)

Conceptually, the Communicator parallels the remote unit with the TRS-80 keyboard. The video display shows everything coming in through the RS-232C port and the keyboard. The port has priority if two entries are made at the same time.

The program is simple to use. The ISI instruction pamphlet is loaded with information on how it works and how it can be modified to meet individual needs. The Communicator is an excellent start for those of you who would like to write your own electronic message system program. It does the hard part of interfacing to the serial port; you can write the rest in BASIC. The Communicator sells for $9.95 from Instant Software.

The other cassette holds Terminal-80, which can, in one of its modes, provide the same kind of remote operation as the Communicator. Terminal-80 also has a dumb terminal mode and LPRINT and LLIST features. The dumb terminal allows full conversational operation with message systems or between TRS-80s. LLIST can send programs out the TRS-80 port for transmission to another TRS-80. Terminal-80 uses a translation table to provide proper transmission and reception of control codes.

Terminal-80 is a good program for persons who frequently exchange data directly. The ease of switching between the host computer and terminal modes makes it easy for two persons running the program to enter each other's system and manipulate files and list and save programs between systems. The ISI instruction pamphlet even contains directions on how to modify a TRS-80 Model I for lowercase operation. The program sells for $24.95 from Instant Software.

ISI has also just recently released a program called Omniterm for the TRS-80 Model I, which just might be the "smartest" terminal program around. I won't go into all of the details yet—it deserves a full review—but if you don't have a smart terminal program for your Model I, or if

Frank Derfler, Jr., PO Box 691, Herndon, VA 22070.

you aren't happy with the one you do have, then you should consider this program. Omniterm is available for $95 on disk from Instant Software, Peterborough, NH 03458.

Mailbag

Let's see what's in this pile of mail on the desk. Here is a note from Lance Micklus. He wants everybody to know that he has a version of the ST80-III terminal program for the TRS-80 Model III (see Dec. '80 "Dial-up Directory," p. 202). And a letter from Don Stoner and the folks at the Microperipheral Corporation says they have a cassette or disk terminal program they call Smart 80 for the Model III.

Here is a notice from the folks at Atari. The 800 and 400 systems come with several excellent books on programming and operating, but they contain no nitty-gritty information on the hardware or operating system. This has been particularly frustrating to small software and gadget companies who would like to provide programs and accessories for these fine computers.

But Atari is ready to tell all. For $27 (plus $3 shipping) Atari will send you the operating system and hardware manuals for the Atari systems. Now we should really see the goodies for Atari start to roll out. Call them at 800-538-8543 (800-672-1404 in California) to place an order.

I've received many letters from readers asking basic questions about how to get started using data communications systems. Here is a typical one from a gentleman in Cumberland, RI. He asks, "How do you use material from a file to leave messages on bulletin boards? Also, how do I know if I should use seven-bit or eight-bit words? How many stop bits and what parity should I use?"

Since these questions are so commonly asked, let me review the most common practice again. Usually, systems use seven-bit words, even parity, and one stop bit at 300 baud (two at 110 baud). The format probably is not critical to successful communications. Parity often is not counted by "hobby class" systems, so it may be of no importance. You might go for years with the setup described and never meet a system you could not enter.

How to transfer prestored messages and files is a much more difficult question. The answer hinges both on the software you are using and the system you are transmitting to. Your terminal software must be able to transmit the contents of files out through the serial port as ASCII characters. In some cases, this can be done simply with a command like LIST. Files stored in unique ways (compressed, hex, etc.) may have to be converted before transmission.

The system you are transmitting to determines how your data can be sent. The Mail system on The Source is very easy to send to. After it is ready to receive your message (the TO and SUBJECT questions answered), it will accept a steady stream of characters. Termination is done by a special .SEND command.

Other systems, such as CompuServe's Email and most Apple Bulletin Board Systems, ask for your input one line at a time with a wait and prompt between lines. Your software must wait for the prompt and transmit the next line only after receiving it. Many large mainframe systems may even prompt a character at a time.

The bottom line is, have a good terminal program. We have reviewed and mentioned many programs in these columns and there are many more to come.

Well, let's see what else is buried under this stack. Ah, here is a handy pocket guide to The Source they recently released. It is much easier to use than most of their previous documentation. The Source has initiated a conference and discussion feature allowing interchange on selected topics. So far, the most popular topic seems to be how to use electronic conference systems.

The Source is now carrying a listing of electronic message systems (bulletin boards, forums, etc.). Source users can read this list by entering: BASIC(11) TCH416>READ at the system prompt (>). The list has annotations on the status of systems, and the author (Donnie, TCH322) welcomes updated information.

They have also initiated a number of user-contributed special-interest files. These include files on record reviews, video music, PET, authors and FCC actions. Entering DATA SHARE at the command prompt will get you started.

The Source is still adjusting to the addition of some greatly expanded computing power. We will visit with them soon to find out what kind of service their new computers are providing.

ABBS Info

That reminds me—several people have written asking how to contact Craig Vaughn regarding ABBS software. Craig is now affiliated with The Source and living in northern Virginia. This area has become the hotspot of commercial data communications activity. Craig and Bill Blue each had a hand in developing the original ABBS system software, and Craig is marketing the latest version (about $65). He can be reached at Micro Software Systems, 7927 Jones Branch Drive, Suite 400, McLean, VA 22102 (phone 703-385-2944).

Craig has been working on version 4+ of the ABBS software. If you want to see one of the most advanced electronic message systems around, you might try dialing into Craig's development system at 703-255-2129. It isn't always up, but if you catch it you will enjoy experimenting with many of the features. Craig has included special user bulletin boards within the message system and many other features.

CompuServe

Speaking of special-interest systems, CompuServe now has special-interest subsystems running for Microconnection users, amateur radio operators, Heath computer users, TRS-80 operators and Model III owners. They also carry special corporate newsletters from both Radio Shack and Atari.

Some of the special-interest subsystems are a little tricky to get into. Commands are entered from Micronet. One typical entry into the Microconnection system would be IRUN USER.CMD [70003,241]. You can get to any other subsystem from there. These subsystems contain a wealth of information and provide a very nice national forum for the exchange of information.

Keep It Coming

I haven't reached the bottom of my mailbag, but I have run out of space. If you operate a message system or market a data communications product, I would like to hear from you. Questions and comments are always welcome, but please include a stamped envelope if you expect an answer to paper mail. Send electronic mail to TCB967 on The Source, 70003,455 on CompuServe or via the AMRAD CBBS (703)-734-1387.□



See List of Advertisers on page 242

Compiled by Eric Maloney

Micro Primer For Educators

Classroom Computer News

The Classroom Computer News

"It was clear to me that information on computers suitable for educators was sorely lacking," says Lloyd Prentice.

So with the support of Intentional Educations in Boston, MA, Prentice helped found the *Classroom Computer News*.

The bimonthly magazine is one of the more impressive of the new specialized computer publications. Faced with the dual curse of computer and education jargon, it has managed to avoid both, instead publishing material that is well-written and well-edited. And though the magazine is printed on newsprint, it is clean and professionally designed.

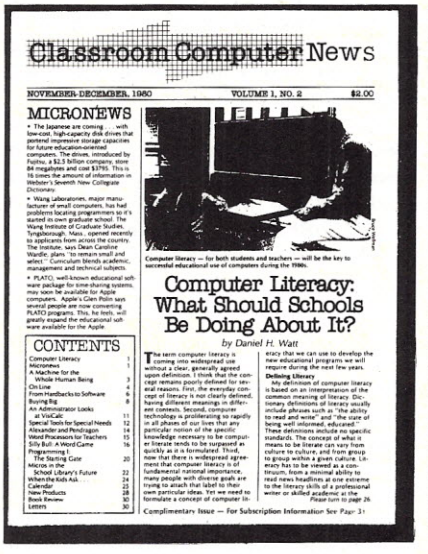
Prentice, a professor of education at Boston University, says that *CCN*'s objective is to help "put educators in control of the technology."

"We're concerned with the way the computer is being used in classrooms," he says. "If it's misused, it could be very oppressive; but if it's used to its potential, it could be very exciting."

The *CCN* manages to squeeze a wealth of information in its 32 pages. The January-February issue, for example, included articles on grant-seeking, educational software, a high school math program, a software evaluation consortium and pocket computers; dart board and constellation-plotting programs; a review of the Sinclair ZX-80; standing features such as "When Kids Ask," "Administration" and "Media"; book reviews; new products; and short news items.

The magazine is not afraid to discuss the political and social issues, either. One Prentice editorial, for instance, tackles the problem of unrewarded expectations.

"Emotionally, the computer promises power," he says. "We've seen that up until now computerized control of information has given government, banks, insurance companies and other large businesses enormous power in our society. So we've come to expect that access to



Classroom Computer News

NOVEMBER-DECEMBER, 1980 VOLUME 1, NO. 2 $2.00

MICRONEWS

• The basement are coming . . . with low-cost, high-capacity disk drives that portend impressive storage capacities for future education-oriented computers. The drives, introduced by Fujitsu, a $2.5 billion company, store 84 megabytes and cost $3795. This is 16 times the amount of information in Webster's Seventh New Collegiate Dictionary.

• Wang Laboratories, major manufacturer of small computers, has had problems locating programmers so it's started its own graduate school. The Wang Institute of Graduate Studies, Tyngsborough, Mass., opened recently to applicants from across the country. The Institute, says Dean Caroline Wardle, plans "to remain small and select." Curriculum blends academic, management and technical subjects.

• PLATO, well-known educational software package for time-sharing systems, may soon be available for Apple computers. Apple's Glen Polin says several people are now converting PLATO programs. This, he feels, will greatly expand the educational software available for the Apple.

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Computer literacy — for both students and teachers — will be the key to successful educational use of computers during the 1980s.

Computer Literacy: What Should Schools Be Doing About It?

by Daniel H. Watt

The term computer literacy is coming into widespread use without a clear, generally agreed upon definition. I think that the concept remains poorly defined for several reasons. First, the everyday concept of literacy is not clearly defined, having different meanings in different contexts. Second, computer technology is proliferating so rapidly in all phases of our lives that any particular notion of the specific knowledge necessary to be computer literate tends to be surpassed as quickly as it is formulated. Third, now that there is widespread agreement that computer literacy is of fundamental national importance, many people with diverse goals are trying to attach that label to their own particular ideas. Yet we need to formulate a concept of computer literacy that we can use to develop the new educational programs we will require during the next few years.

Defining Literacy

My definition of computer literacy is based on an interpretation of the common meaning of literacy. Dictionary definitions of literacy usually include phrases such as "the ability to read and write" and "the state of being well informed, educated." These definitions include no specific standards. The concept of what it means to be literate can vary from culture to culture, and from group to group within a given culture. Literacy has to be viewed as a continuum, from a minimal ability to read news headlines at one extreme to the literary skills of a professional writer or skilled academic at the

Please turn to page 26.

Complimentary Issue — For Subscription Information See Page 31

cheap and powerful information tools will give us the same. But we must remember that power comes from political advantage and economic scarcity, not through purchase of what is essentially a consumer commodity."

Since Altair

Prentice has been interested in microcomputers since the early days of Altair. In 1977, he proposed a graduate-level course at Boston University on computers in education. The school agreed that it was a good idea.

"It was an instant success, and has been standing-room-only ever since," Prentice says.

Prentice found support for the magazine from Intentional Educations, a nonprofit curriculum development organization. They decided in June to go ahead with the project, and the first issue came out in September of 1980.

The magazine circulates about 37,000 copies, of which about 1400 are paid subscriptions. But, says Prentice, most of the promotion has been done only in the magazine itself. He hopes to have 10,000–12,000 subscribers by the end of the year.

The magazine boasts a full staff on its masthead, including an associate editor, features editor, contributing editors, regional contributors, an art director, a circulation manager and a director of advertising. Prentice says that they decided early to focus their energies on the editorial product.

"Our main concern is with the quality of the editorial matter," he says. "We can satisfy the advertisers with slick paper, or our readers with quality material. We chose our readers."

He says that the magazine is heavily edited, so that it will be presented in "plain English."

So far, Prentice says, the reception "has been phenomenal."

"People are already saying that we're going to be one of the most influential publications in the field," he says. "Readers are actually offering their services to us gratis."

Classroom Computer News has taken giant strides. Educators will find it to be an important tool as they seek ways to use microcomputers "in ways that are liberating rather than oppressive."

A one-year subscription to Classroom Computer News *is $9. Address inquiries to Box 266, Cambridge, MA 02138.*

VDT Blues

Are video display terminals harmful to your health? A variety of complaints by editors and reporters working in automated newsrooms has raised the possibility. Now the Newspaper Guild and the Mount Sinai School of Medicine in New York City have laid plans for a comprehensive study of 2000 employees in American and Canadian Guild locals.

Through eye exams, radiation tests

and questionnaires, the study will try to determine whether VDTs do, in fact, pose a health problem, from either nonionizing radiation or other causes. It is being done in conjunction with a larger survey planned by Mount Sinai and the Workers Institute for Safety and Health.

The study is in response to a number of reports of health problems among newspapermen working on VDTs. According to the January-February issue of the *Columbia Journalism Review*, at least five journalists have developed cataracts that might have been caused by VDT radiation. The magazine also reported that four pregnant women working with VDTs at the Toronto Star gave birth to children with birth defects.

Scientists have long agreed on the damaging effects of ionizing radiation, such as is associated with nuclear power plants and X-rays. But the biological effects of nonionizing radiation—which does not alter the structure of cells—have been the subject of a great deal of controversy, particularly since the boom in commercial microwave ovens.

The thermal effects of nonionizing radiation in large doses are apparent to anyone who has ever used a microwave, but scientists vigorously disagree over whether low-level doses can be harmful. Animal experiments have shown evidence of behavioral changes, while some doctors also claim to have discovered hormonal imbalances and hematological changes in humans.

The Newspaper Guild-Mount Sinai project will begin later this year.

Ward, Sears Leap In

Montgomery Ward and Sears, Roebuck, and Co. have reached agreements with manufacturers to market microcomputers.

Ward will be selling the Ohio Scientific line, while Sears will market the Atari 400 and 800 micros.

Ward has already opened four stores—two in Texas and two in Minnesota. The OSI shops are located in Ward department stores, and are designated Montgomery Ward-Ohio Scientific Computer Shops. They will sell the Challenger 1P and 4P microcomputers.

While initial reports said that OSI planned to market a business system through Ward, spokesman Bill Koppelman says that the stores will concentrate on the home computer market.

"We're not letting Ward sell business systems, because they can't sell them properly," he says. "A business system needs a lot of support that you really can't give in a retail outlet."

He says that the stores will be manned by OSI personnel, although a few will have M-W clerks trained by OSI.

"I assume this is a control group that they're using to see how successful they are," he says.

Koppelman says that well-trained sales people are the key to how well the stores do. He says that the original Sears-Atari experiment failed because "they had inexperienced clerks selling the product. A $3.50 an hour clerk is going to have a hard time selling a $1000 product."

OSI and Ward had hoped for 19 stores by the end of 1980, but ran into "logistical problems." They hope to eventually expand to about 50 outlets.

The four shops already in operation—in Friendswood and Pasadena, TX, and Bloomington and Roseville, MN—were selected for the department stores' size and the amount of traffic. All four are in large suburban malls near large cities.

Finding out what Sears and Atari are up to is a major chore. Sears has sold the Atari since December 1979 in some of its larger stores, and offered it for a while through its catalog. One Atari spokesman acknowledged in February that the 400 and 800 micros were being sold, and even said that Atari was hoping to "set up some kind of training program for sales personnel"; meanwhile, Director of Public Relations Michael Fournell was saying that "Sears is talking to us but nothing has been nailed down."

In January, Sears said that it was planning to open five business-machine specialty stores by late fall of 1981, but declined to say which computers the stores would offer. Apple, Commodore and Atari were all mentioned as possible partners.

Finally, at the American Toy Fair in New York last February, Atari President Ray Kassar said that Atari and Sears had reached an agreement, but Sears wouldn't confirm his statement.

Computers through Subscriptions

Elementary schools and their students will soon be able to earn Tandy computers, software and users courses by selling books and magazine subscriptions.

The program is being offered by Tandy and QSP, a magazine subscription sales organization.

The way the program works, children in grades K–6 buy books or sell subscriptions and subscription renewals to parents and relatives. The school then receives a credit equal to 40 percent of the money raised. It can use that credit for a TRS-80 or software, or to send school personnel to microcomputer-user courses sponsored by Tandy.

William E. Drake of QSP says that the firm is contacting schools, but that "it's pretty much a soft-peddle right now." He says that the program will probably not go into full-swing until this coming fall.

QSP, a subsidiary of Reader's Digest, Inc., is used by schools and nonprofit organizations primarily for fund-raising. High schools will, for example, sponsor subscription drives to help pay for dances

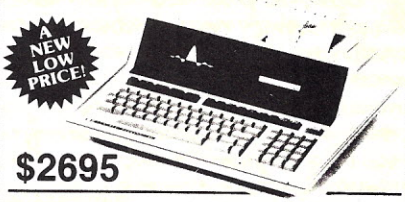
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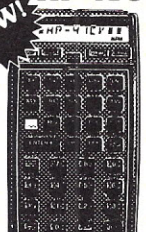


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and other class activities.

For more information on the program, contact William E. Drake, QSP, Inc., Box 2003, Ridgefield, CT 06877.

RFI I

Centronics Data Computer Corporation's models 730 and 737 printers have been modified to meet the Federal Communications Commission's radio frequency interference regulations without a resultant price increase.

"It turns out that we had a good design to begin with, and were at the point where we were making some modifications anyway," says Steve Robinson, Centronics manager of microcomputer printers.

Centronics, which is based in Hudson, NH, sent out a news release on Feb. 25 stating that the printers had received class B certification. Class B computing devices are those which are intended for use in residential areas.

The original deadline for certification was January 1981, but many companies—including Apple, Commodore, Exatron, Lobo and Heath—received extensions until April 1. Some companies, like Apple and Heath, have already announced that modification costs will be passed on to the consumer.

A complete story on the new RFI regulations appeared in *Microcomputing*'s April issue ("FCC Takes Aim Against RFI Polluters," by Chris Brown and Eric Maloney, p. 30).

RFI II

Also on the RFI front, the Federal Communications Commission has adopted procedures for manufacturers to use in testing and verifying computing devices.

Verification is required for those devices that do not need certification. This includes Class A equipment (including computing devices intended for commercial use) and most Class B equipment. In verification the manufacturer does not have to notify, or get approval from, the FCC.

The new procedures go into effect on July 1. Until then, computing devices can be tested with either the new or interim procedures. Devices already verified don't need to be retested.

Programs Unlimited

A software supermarket has opened at the Westbury Shopping Center in Jericho, NY, on Long Island.

Programs Unlimited owners claim that it is the first of its kind in the country, and say that some 100 more stores are planned over the next two years.

The major feature of the store is that customers are able to test software before buying. Computer models available include the TRS-80, Apple II, Commodore and Atari.

The store carries some 600 programs from a variety of sources. According to the press release, these programs are pretested and selected by "a team of experts." The store also offers customers a money-back guarantee if the software they buy is unsatisfactory.

Programs Unlimited will also sell books, computers and peripherals.

Programs Unlimited's president is Richard Taylor, who, in addition to being a veteran of the New York City Opera Company, is a computer programmer.

Programs Unlimited is a wholly-owned subsidiary of Cut & Curl, Inc., which runs some 500 hair salon franchises.

Software Markets

Two software guides, one for vendors and one for consumers, are now available.

The *1981 Software Writers Market* lists some 1800 places where authors can market their software. It includes service bureaus, computer manufacturers, mail-order specialists, book publishers, computer magazines, consulting companies and 1500 retail computer stores.

Each entry tells how the firm markets its software, how it acquires software from independent vendors, what kinds of software it wants, royalty rates, contract details and who to contact.

The *Market* is available for $45 from Kern Publications, 190 Duck Hill Road, PO Box 1029, Duxbury, MA 02332 (617-934-0445).

Micro-Serve's fourth edition of the *Software Vendor Directory* includes 1001 software vendors, 4195 products, and is indexed by 80 hardware and 200 software categories. It is geared toward microcomputer owners, hardware and software vendors, computer stores, consultants, programming services and marketing consultants.

The purpose of the *Directory*, says the press material, "is to reference applications for a specific microcomputer, to find support software such as operating systems, programming languages, utilites, etc., and to provide an overall view of the microcomputer marketplace."

The *Directory* costs $57.95, or $100 with two updates. A disk version is available for $78.

For more information, contact Micro-Serve at 250 Cedar Hill Ave., Nyack, NY 10960 (914-358-1340).

Suit Yourself

It seems like everyone wants to get into the act.

Tandy Corporation has filed a suit in San Francisco against Personal Microcomputers, which markets the ZX-80 microcomputer, charging conspiracy and infringement on the design of the TRS-80.

According to Tandy, "at some time after plaintiff introduced its TRS-80 microcomputer into the market, defendants collaborated to produce and market a microcomputer similar to the TRS-80 and containing input-output programming copied from plaintiff's TRS-80. Defendants have marketed said microcomputer under the name PCM-80, which is confusingly similar to Tandy's registered trademark TRS-80."

Also named in the suit are Eaca International, Ltd., Eaca Electronics Corp. of America, Compumart, Consumer Computers Mailorder and Robialle & Sons Enterprises, Inc.

Meanwhile, Tandy is one of several outfits being sued by Coleco Industries for trademark infringement. Coleco was recently awarded the patents to several electronic games, and is now trying to "police its patent property against infringement." The other firms being sued include Mattel, Inc., Bambino, Inc., Barney of Hong Kong Ltd., Calfax Inc., Conic International H. K. Ltd., Entex Industries Inc., Pro-Quality Electronic Co., Tiger Electronic Toys Inc. and Tudor Games, Inc.

On another front, Atari, Inc. is pursuing a suit filed against Activision in May 1980 for conspiracy and theft of trade secrets. In a press release sent out this past Feb. 17, Atari said that it was amending its complaint against Activision and four programmers "on the basis of facts learned during discovery which Atari asserts reveal a willful and malicious conspiracy to steal trade secrets. The amendment explains that while the four programmers were in the employ of Atari and entrusted with the confidential know-how to design and develop Atari game cartridges, they and others entered into a wrongful scheme to appropriate Atari's property; and to enter the market without incurring significant research and development costs."

Atari is asking for $20 million in damages.

Tandy and Dow Jones

The Dow Jones Information Services database is now available to owners of Radio Shack's TRS-80 micros and Videotex equipment.

The database includes current and past news stories from the Dow Jones News Service, the *Wall Street Journal* and *Barron's Weekly*, all Dow Jones publications.

The service also offers price quotations and such information as revenues, earnings, dividends and price-earnings ratios.

The Videotex programming package is for the models I, II and III micros, the Color Computer and the Videotex terminal. Purchasers will receive a password and one hour of free usage.□

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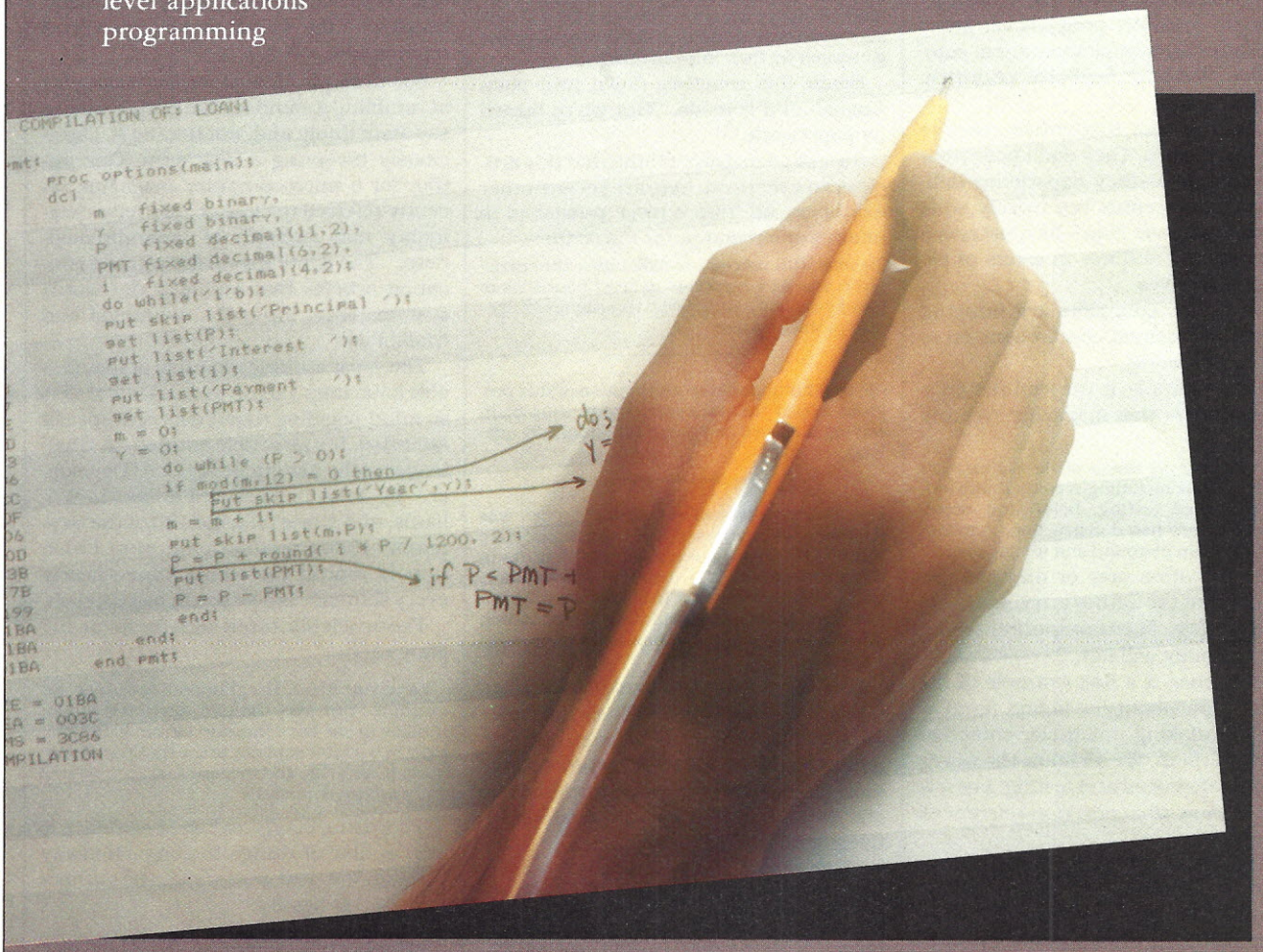
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By Eric Maloney

A Language Of Their Own

Time to Reeducate Educators

Computerists have committed many horrific crimes against the English language, some of which have been noted in this column. But a new subgroup is emerging, one which threatens to set new standards in obfuscation—the computerist-educators.

Educators, of course, have a solid reputation for general incoherence. They like absurdly long and convoluted sentences, full of meaningless or overused words—innovative, creative, progressive, interactive, utilization, implementation, categorization, dialogue, facilitate, prioritize, actualize, finalize.

Children are not inattentive—they're attention deficient. They don't have trouble with lessons—they experience difficulty. A teacher must not merely state the goals of a lesson plan—he must specify instructional outlines in terms of behavioral objectives.

And now the educators are bringing their crusade against comprehension to the computer world.

Here, for example, is the lead sentence of a manuscript this magazine recently received:

> Major educational issues of the eighties are likely to continue including accountability, criterion-referenced testing, behavioral objectives, competency-based instruction, individualized education, planning and management.

Other educators may or may not understand what the author is trying to say. But the average *Microcomputing* reader almost certainly will not.

The sentence is a fine example of the educator's penchant for taking familiar words and making unfamiliar combinations out of them. We all know the words criterion, referenced and testing, but few of us will know what criterion-referenced testing is.

To the educator, such terms sound erudite and professional. To the rest of us, it's garble. The author might just as well have referred to criterion-based objectives, competency-referenced instruction and behavioral testing.

The education field, of course, needs new terms to define new ideas. Outsiders can't be expected to understand all of it, any more than a noncomputerist can be expected to know what handshaking is. But educators also seem to have trouble expressing thoughts that have nothing to do with their specialized knowledge. Take, for example, the follow-up sentence to the one cited above:

> But consistent and comprehensive utilization of these concepts has been considerably restricted mainly because of the problems associated with the huge mass of data required in and generated by their implementation.

Break this sentence down into plain English and it reads, "But we're buried by paperwork."

Just so people don't think that this article is an exception, here are several other examples, all from a piece published in another microcomputer magazine:

> To cope with procedural difficulties, the curriculum was to incorporate general heuristics of problem solving and special techniques for specific problem types.

> Clearly, an underlying assumption of this program is that the translation stage of problem solving is crucial and that it is dominantly analytic.

> Research on problem solving difficulties was reviewed and assessed, and decisions were made to incorporate several special features in the curriculum: a redundant vocabulary, multi-level presentation to conform with what is known about structural difficulties, and an attempt to teach general heuristics of problem solving.

How do educators manage to be so confused and inarticulate? They are, after all, the ones we entrust to teach our children, and are therefore supposed to have more advanced and refined skills. Why are they unable to communicate effectively with the rest of us?

Much of it is learned in college, where students find that many instructors respond well to jargon and highfalutin language. If they throw around the proper terminology in their papers and exams, they can prove that they know the material—even if they don't. The jargon becomes reinforced by their professors, their reading and their fellow students, and soon becomes the only language they know. Eventually, the ones who become researchers and college professors continue the cycle by inventing new jargon.

But also—as appalling as it may seem—many educators simply do not know how to use the tools of the language. They don't know how to take an idea and translate it into words that everyone can understand.

For example, educators are wonderful at fumbling around for the proper way to say something, and, not finding it, capriciously inventing a new term. One author for a microcomputer magazine recently referred to "loss of creativity, originality and strength of inner-directedness." The same magazine printed education articles that included the words systematicity, limitedly, exampled and trialability.

The most striking example of insufferable educators' jargon to cross my desk is so mind-boggling that it deserves special attention. It's an article entitled "A Challenge for the Language Arts CAI Developer," by John G. Allee and Robert L. Williams, and starts on page 120 of the September 1980 *Creative Computing*. I wish I could reprint the whole piece—nearly every sentence is a lesson in bad English.

The article starts out with the following paragraph:

> Language Arts CAI—grammar and usage, for example—provides the CAI developer opportunities to use the computer terminal dynamically in ways far superior to the traditional textbook, if language and the terminal are assessed and employed carefully.

This disturbingly awkward sentence is only a hint of things to come. Halfway through the next paragraph, the authors uncork this beauty:

> Although writing limitedly [!] affects the individual's life at first, its impact increases progressively through the school years, as it is received by sight and reinforced by ear and sometimes reproduced to be sent to a limited audi-

Small Printers

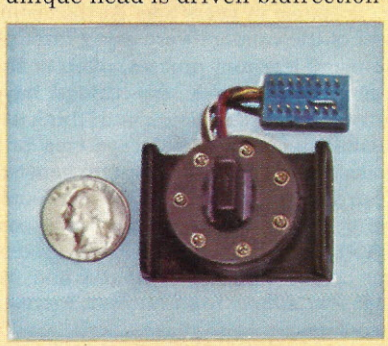


Big Performers

OKIDATA MICROLINES

The Okidata Microline 80 printer set the standards for the home computer market. Now there are two new low cost Microlines for business use that have already won the praise of the most demanding OEMs—the Microline 82 and 83—setting new standards for performance, reliability and flexibility.

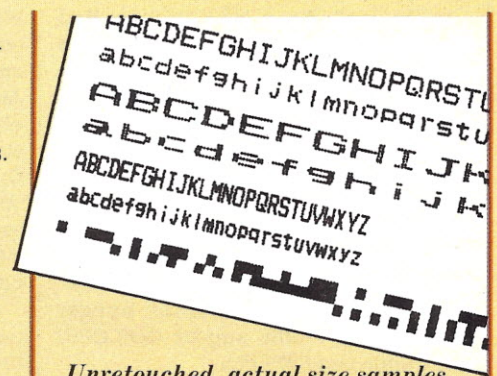
Using a tiny, seven-pin head that weighs less than four ounces, the Microline 82 and 83 produce sharp, crisp copy *and graphics* on plain paper, multipart forms. The unique head is driven bidirectionally by an elegantly simple mechanism at 80 cps in the Microline 82 and 120 cps in the 83. Short line seeking logic further boosts throughput by 80% over equivalent unidirectional printers.



The low mass, high performance Microline head is warranted for 200,000,000 characters.

OEM savings add up because there is no need to stock different models (and spares) for different customers. The Microline 82 and 83 include *both* RS232C serial and Centronics-compatible parallel interfaces as standard equipment. Both printers have friction platens that accept adjustable snap-on tractors and form controls that include vertical tab, top of form and a vertical format unit.

Since 1972, Okidata has been building the best. There are thousands of Okidata printers in computer rooms throughout the world bearing nameplates of the top OEMs in the industry. The same standards of excellence have been applied to the low cost Microline Series—two motors, rugged cast aluminum base, *no* compromises. Call today for details. Representatives throughout the world.



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ence that is often impersonal, static, frequently almost noninteractive so the good faith corrections and recorrections available in oral language virtually disappear.

Later, they crank out another, though lesser, gem:

The student participating with the terminal, for instance, can indirectly help solve some of the problems that language instruction imposes: context—exampled by one problem noted earlier—can be made almost real by the student because the student can be asked, for example, to input characters—names of his classmates—which the terminal then can use in its presentations.

The writing is bad enough. The fact that the article is about teaching language skills turns it into a perverse parody. But most disturbing, one of the authors—John Allee—is a university English professor.

Readers should be aware of a notable exception to the above complaints: the *Classroom Computer News*. This new magazine, published by Intentional Educations in Boston, MA, is well-written, well-edited and well-presented. Computerists and educators will both find it a worthwhile model.

* * * * *

News releases are often wonderful sources of amusement. Take, for example, this one from Osborne/McGraw-Hill. In describing a new book, the release claims that "5 devices are indepthly covered." It took an ingenious mind to turn "in-depth" into an adverb. Not even Webster's, which has the gall to include the adverb ingrainedly, lists indepthly. What's next? Inhousely? Inflightly? Uptotheminutely?

* * * * *

In the mail: From New Orleans, Ken Shacter proffers the theory that the word snivitz—defined by the *Microcomputer Lexicon* as "a small pulse of noise"—might come from snvt, "a notation used by nuclear engineers familiar with boiling water reactors to denote the integrated neutron flux that has impinged upon a control rod or in-core instrument." He cites several other words coined by General Electric's Nuclear Energy Division: mick purr (MCPR), mapull hugger (MAPLHGR), muffle supper (MFLCPR) and muffle pad (MFLPD).

In case anyone is interested, s equals a factor of 10^{21}, n is the neutron density (neutrons/cm^3), v is the neutron velocity (cm/second) and t is the irradiation time (in seconds). "Dimensional analysis of snvt results in units of time integrated neutron fluence, neuts/cm^2," he says, and I'm not about to argue.

I don't readily see the connection between the two, but considering the close relationship between the computer and nuclear industries, it's certainly possible.

William Lindley of Bedford, MA, points out that buss is incorrect; the word has only one s. He further points out that buss means "kiss." "Certainly," he concludes, "Nobody means 'S-100 kiss'!" Well, you never know. . . □

LETTERS TO THE EDITOR

Judging Operating Systems

Richard Fritzson's otherwise excellent tutorial on implementing file systems ("Data on Disk," January 1981, p. 111) was marred by his lack of experience with linked list systems. His main criterion for downgrading linked systems is false, and he avoids several criteria where linked systems excel over the CP/M systems he promotes.

He claims that linked allocation can't support random access files. The Flex operating system by TSC is a widely used linked list system which does feature random files. When a random file is opened, Flex puts a sector map of the file at the start of the file. Using the sector map, Flex can access any sector in the file in truly random fashion. Disk space is conserved by only generating sector maps for random files.

Considering the limited mass storage on small computers, the author should have mentioned how efficient linked lists are. CP/M allocates disk space eight sectors at a time; thus, the average file has four wasted sectors (512 bytes). Flex allocates one sector at a time and thus never wastes a sector (average waste is one-half sector, or 128 bytes). A linked list will not give a disk full message until every sector is utilized.

As mentioned, linked lists will scatter a file around the disk. But, in all fairness, one must mention that this does not occur until all sectors have been used once. Also, since deleted files are added to the chain of available sectors, the chain consists of "chunks" of adjacent sectors. One seldom has more than one or two discontinuities in a file. You can reorder the sectors by copying the disk, which is equivalent but safer than the "squeeze" operation used on other systems.

Another consideration is directory capacity. Since the Flex directory is itself a linked list, you can have as many files as you can fit on the disk. Directory entries include creation date and are a fixed length (regardless of file size). Since small command files can be one sector long, it is not uncommon to have over 100 utilities on a system disk.

When CP/M users encounter a disk that has just one defective sector, they usually are forced to throw it out. Since the linked list allocates one sector at a time, the disk formatting programs will delete bad sectors when encountered, allowing me to use free disks being rejected by users of other systems.

One final criterion for judging operating systems is ease of access from assembly language programs. CP/M is so complicated that most users are afraid to exit their high-level languages. Flex is so easy to call from assembly language that users are encouraged to try what I consider the most challenging and rewarding facet of personal computing: system level programming.

Leo Taylor
West Haven, CT

Response:

My article wasn't intended to compare operating systems (or promote CP/M), but only examine methods of allocating disk space. Flex gets around the genuine problem of linked allocation and random access by adding sector mapping to its basic linked allocation scheme; this consumes some of the space it saves by allocating one sector at a time.

CP/M's fixed directory size is a regrettable fault of CP/M in particular and not of the mapped allocation technique. There is no reason that CP/M's directory could not be an expandable file.

The same goes for defective sector handling. CP/M users can buy a program (from Lifeboat Associates) which allocates defective blocks to an invisible file allowing continued use of a disk with defective sectors. CP/M can be faulted for not coming with such a utility, but it's not a defect of mapped allocation.

Flex may well be easier to use than CP/M. If it is though, it is because the operating system as a whole is better designed and implemented and not because it uses linked sector file allocation.

Richard Fritzson
Buffalo, NY

More on Word Processing

I was very interested in your comments ("Word Processor Woes," November 1980, p. 7) relative to the problems you had with a word processor system. It appears you suffered the same problems that lots of people did who invested in a word processor system early in the game, i.e., a couple of years ago. At that point most of the vendors were going through the usual learning process, often at the customers' expense. But things have sorted out a good deal now and I think it is possible to get very useful systems for a modest investment. My system consists of an Intertec SUPERBRAIN computer and a Comprint 912 printer—total cost $3500. The software is the CP/M system that comes with the computer and the Mate text editor, from Michael Aronson Associates.

Gerald R. Peterson
Tucson, AZ

I have been joyfully editing and formatting text ever since I bought my micro from Power's Computers in Richmond, CA, nearly a year ago. Since I am a doctoral candidate in English literature with practically no technical background, learning how to select and use and maintain software and equipment was challenging, but well worth the effort. Hugh Power was helpful as well as knowledgeable in his sales approach.

I currently use an Intertec Data Systems Intertube and a reconditioned Selectronic terminal as peripherals to my double density, dual driven 32K Horizon with North Star DOS 5.0. The system is used for programming as well as word processing, and the North Star BASIC is a pleasure to use with its own line-editing and renumbering commands. The line-oriented Text Formatting System (TFS), which I acquired for a pittance, is not the most elegant of text editors, but buying it kept the cost of my entire system under $5000. That price may be a little steep for the average hobbyist, but I believe that most dedicated word processors cost three to four times as much.

I have had virtually no hardware or software problems with my system despite the fact that the equipment is partially accessible to the public and minimally documented. Except for the ac voltage used to power the machinery, I have not yet had to spend a penny in maintenance or repair costs.

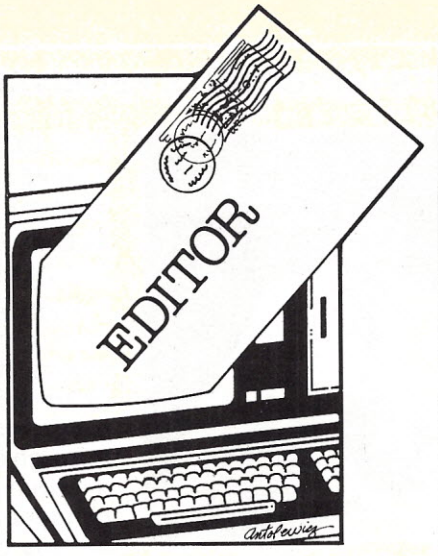
Frankly, I love my word processing microcomputer.

Ann Hernandez
University of California, Berkeley
Berkeley, CA

I have been successfully using a microcomputer with word processing software for about eight months. I have an Alpha Micro AM-100 computer, dual Persci 277 disk drives, a NEC 5525 Spinwriter and a Lear Siegler ADM-42 video terminal. With these I am using the word processing software package produced by Datalab, Inc., of Ann Arbor, MI.

The hardware has been quite reliable, and the software easy to use and effective. My computer is my secretary. With it I write letters, legal briefs and other documents on a daily basis. Most of my work is individualized: affidavits, memoranda of law and briefs that run from a couple to 50 pages or more. For these I write the text on the CRT terminal instead of using the traditional yellow pad or dictation. I can check and edit my work on the CRT, and I print drafts and final copy on the Spinwriter. For forms, bills and letters I have produced standard templates which contain standard language and formatting codes. All I have to do is read the standard file into the text file I am writing and fill in the blanks.

The word processing software has been easy for me to learn to use. I learned just by reading the manual and practicing on



the computer. Most commands are entered with mnemonic abbreviations which require little effort to remember. I use the programmable function keys on the ADM-42 to store frequently used formatting codes so that, for example, I only have to push one button to shift from double-spaced text with my standard margins to single-spaced text indented on both sides. Pushing the same function key shifted restores the normal format.

Of course, the system is not perfect. I have suggested improvements to Datalab which I hope will be incorporated in future versions. However, as it now stands it is a good working tool which allows me to produce written documents far faster and more accurately than I could in a traditional office situation.

Robert M. Cohen
Attorney-at-law
Troy, NY

I would like to tell you about our high degree of satisfaction with the Radio Shack Scripsit word processor. We have used it for over six months for letters and manuscripts, as well as for editing BASIC programs, and find it to be very good.

Our system is a TRS-80, Model I, with expansion interface and 48K RAM, with the Radio Shack lowercase modification installed. We have two Percom 40-track disk drives, and use their "Patchpak" to achieve the 40-track operation and correct some TRS-DOS problems. We have also installed the Percom "data Separator circuit" in the expansion interface, to eliminate disk read-write errors. Because of budget limitations, our printer is a used IBM 1980 Selectric terminal interfaced to the TRS-80 by Micromatic Corp. (Indianapolis, IN).

This system has been used extensively by several people in our group. For letters I have a short disk file which contains the print parameters and the heading; these are all loaded in one operation so that the system is immediately ready for typing the letter. Similarly, for manuscripts the print format instructions are loaded from a short disk file and changes needed from the standard print format can be then made simply in RAM.

Combining material from more than one disk file is simple with the Scripsit load and chain command; the second file is appended to the first in RAM. The block designate and move techniques are simple and effective, and allow material from the appended file to be inserted into the main manuscript where desired. We find the search techniques very easy to use and convenient for locating the place for inserting the new material. The global search and replace or delete capabilities are at first quite shocking in their effectiveness.

Any intelligent person can learn to use Scripsit easily and in a very short time using the manual and the abbreviated instruction sheet. One surprising bonus of the system is its speed; a good typist can keyboard material on Scripsit much faster than with an electric typewriter.

We print manuscripts out, double spaced, on fanfold paper. These rough drafts can be carried home for marking at leisure, and the corrections then entered rapidly before printing the final copy.

One limitation is the lack of provision for underscoring copy, since there is no command for carriage return without line feed. There is also no provision for subscripts and superscripts. The automatic page numbering is OK, but the system for automatic addition of headers or footers to pages is tricky to learn (although it works OK, once mastered).

The one main frustration of our system is the slow speed of our printer, but two kilobucks for a daisywheel printer would presumably cure that.

John M. Stewart
University of Colorado
Health Sciences Center
Denver, CO

The response to the editorial "Word Processor Woes" (November 1980, p. 7) was fantastic. These letters are indicative of the many we received citing successful applications with word processing systems. We are pleased that so many of our readers found the time to tell us of their experiences. Unfortunately, space does not permit publication of every letter.—Editors.

Argentine Update

I am writing this letter in response to "The Argentine Connection" (February 1981, p. 60). Your publication is, in my opinion, usually correct; however, I was quite surprised and disturbed by this particular article (in which even the title has negative connotations).

I would call to your attention that there are, in fact, many Radio Shack computer dealers in Argentina (several in Buenos

(Continued on page 243)

ORDER ENTRY/ACCOUNTS RECEIVABLE SYSTEMS



Fyrnetics President, Larry Larsen, and Controller, Dennis Turek, considering some of the features of their new security system.

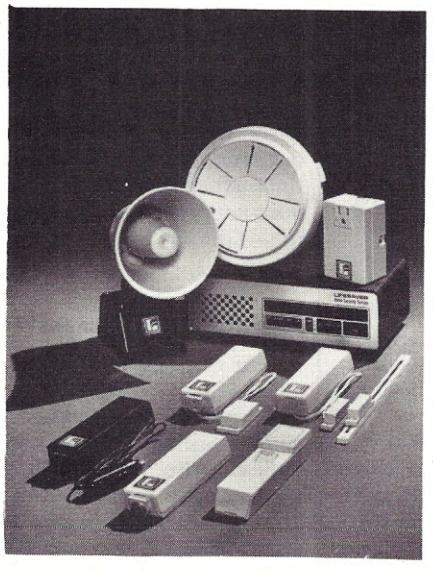
THE COMPANY:
FYRNETICS, INC.
1021 DAVIS ROAD
ELGIN, ILLINOIS 60120
312-742-0282

Fyrnetics, Inc. of Elgin, Illinois has grown from a private manufacturer of ionization smoke detectors for companies, such as Sears & Roebuck, to a full line manufacturer of wireless security products which are sold through a worldwide network of dealers and distributors. Since saturation of the residential security market is estimated to be less than 3% in the United States, their major marketing effort has been directed toward distribution through dealers who demonstrate and sell electronic products to the consumer. This marketing approach generated such a high volume of sales orders and invoices that it became necessary to install a computer system in 1977 in order to handle the multi-million dollar annual sales volume.

"Fyrnetics initially installed a Wang 2200 computer system, equipped with seven CRT terminals, four 10 megabyte hard disk drives, and two line printers at a monthly lease cost of over $4000.00. By late 1979, the company had invested nearly six man-years in our own software development", comments Fyrnetics president, Larry Larsen "As a part of a cost cutting program, we decided to replace the Wang equipment with a microcomputer system. We reviewed all available micro systems and concluded that the MSI hardware and software packages were best suited to our needs."



The modern production facility at Fyrnetics, Inc. where wireless home security products are designed and manufactured. The company also has production facilities in Hong Kong where larger quantities of their products are manufactured.



"We were particularly pleased with the system-generation capability of the MSI business packages, which allowed us to utilize our existing continuous form sales orders, invoices, and packing lists. The requirements for our computer system were rather demanding since we had large customers such as Montgomery Wards and Wicks, each having up to 300 stores. Each store is treated as an individual customer during the order entry and shipping process. However, payment is made from a central accounting office with many stores on a single check. Our system had to allow us to properly credit the payment to many different store locations and invoices. This feature was a part of the MSI Accounts Receivable software package. **Our accounts receivable system handles over 750 regular customers with over 3000 open invoices and 10,000 transactions per month for us."**

The LIFESAVER line of wireless home security products manufactured by Fyrnetics, Inc. Anyone desiring more information on this interesting product line should contact Fyrnetics, Inc. at the above address.

CONSIDERATIONS FOR THE SELECTION OF ACCOUNTS RECEIVABLE SYSTEMS

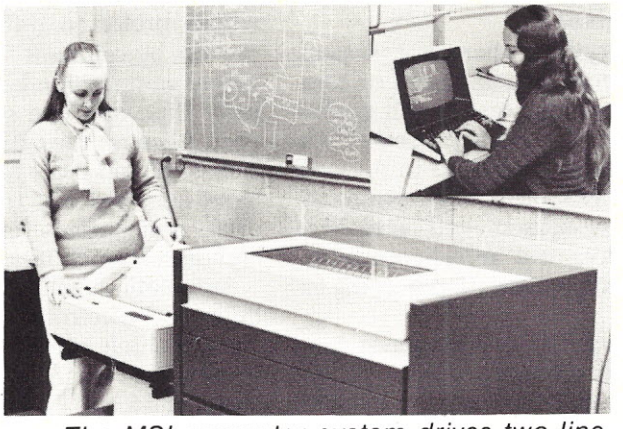
The selection of business computer systems today involves the careful consideration of many different factors. Even though the cost of computer systems has dropped substantially, we considered the selection process to be highly critical to us because of the tremendous need for a highly reliable computer system in our daily operations. Due to our high volume of sales transactions we were highly dependent upon the system for order processing and for information. We considered the following issues to be key to our selection of the MSI system:

LARGE DATA BASE - The processing of over 700 orders per month, with 3000 open invoices and 5000 active statement items required that we have easy and efficient on-line access to our large data base. The MSI system provides a large selection of data reports for open orders, backorders, invoices, credit memos, as well as customer statements and account status information.

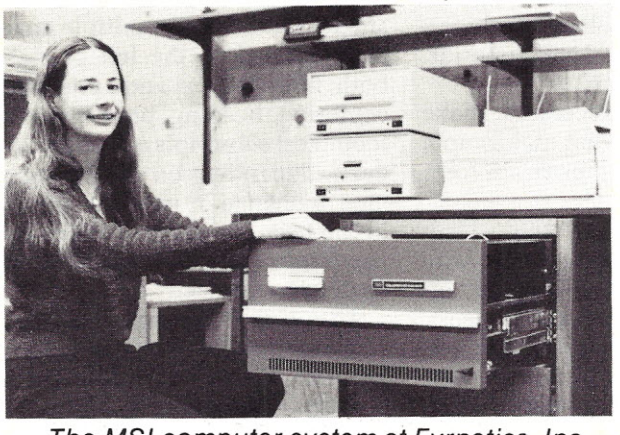
EFFICIENT PAPERWORK FLOW - The processing of our large volume of sales orders required an efficient system for printing sales orders, packing lists, invoices, and customer statements. The MSI system offers a convenient system generation program which allows the use of any desired format for pre-printed continuous forms. In addition, packing lists and customer invoices are generated automatically as sales orders are processed.

GENERAL LEDGER TIE-IN - Due to the large volume of individual invoices and cash receipts, we required an automatic posting procedure for our general ledger programs in order to minimize the data entry process. The MSI system offers a complete general ledger program package which links automatically to the other business program modules. All invoices, as well as cash receipts, are automatically written to the general ledger posting files from which individual journals are created. This procedure insures the generation of balanced journals and greatly reduces the time requirement for generation of monthly income statement and balance sheets.

SYSTEM INTEGRATION - The MSI system is fully integrated. The order entry system is linked to inventory for correct pricing, description of items on order. The inventory system is also linked to general ledger to allow different categories of products sold to be automatically posted to the correct sales accounts. The MSI inventory system provides complete cost accounting information for both labor and material. **The MSI programs provide the big machine capability that we need and yet provide the flexiblilty that we desire.**



The MSI computer system drives two line printers at Fyrnetics, Inc.

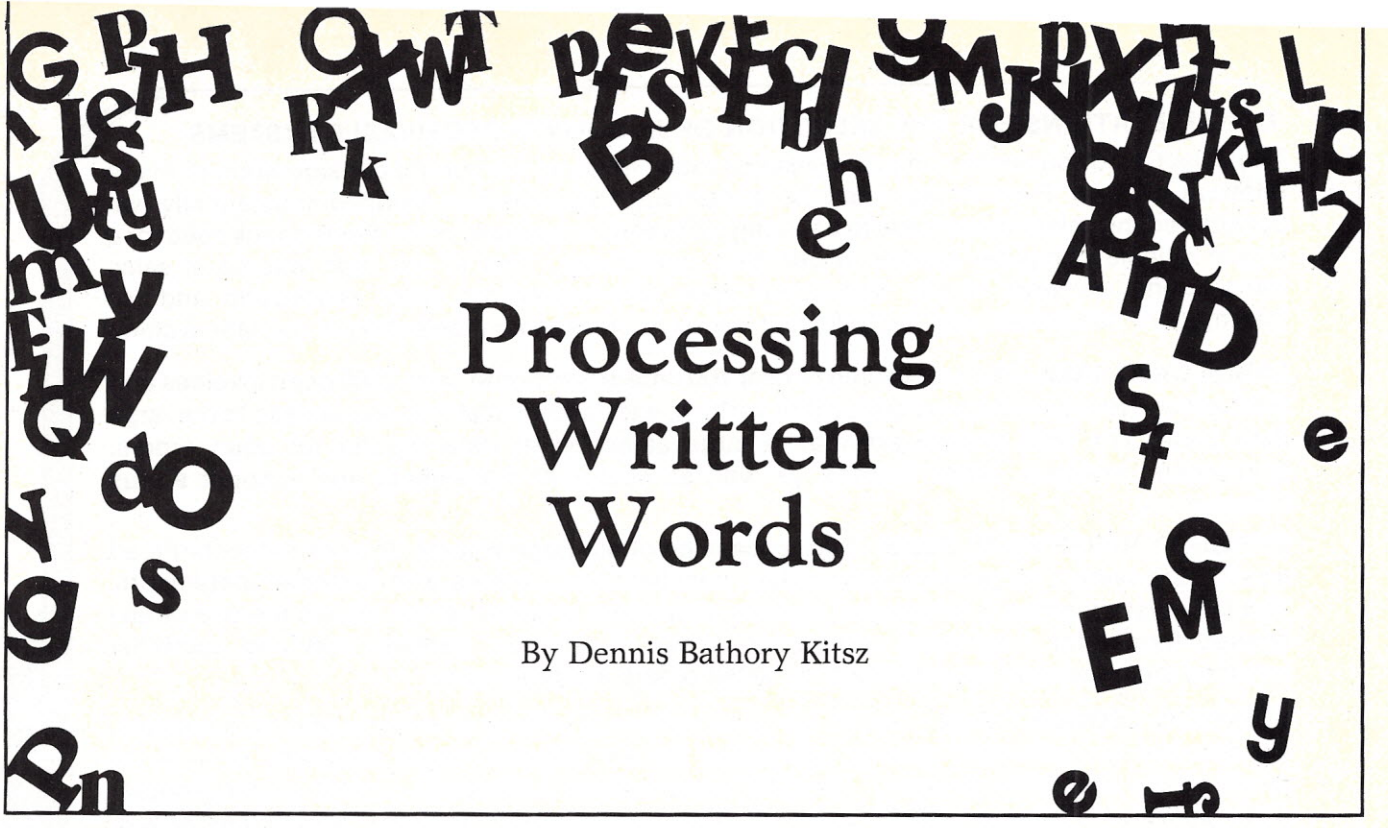


The MSI computer system at Fyrnetics, Inc. employs 10 megabyte hard disk drives to contain the large on-line data base.

SUPPORT - The availability of source listings for all of the MSI business software was an added incentive to select the MSI system. This has allowed us to make some specialized enhancements to our programs easily. **MSI really delivered for us allowing the replacement of an expensive WANG 2200 system with a comparable MSI system at a fraction of the cost.**

If you would like to have more information on MSI business computer systems, call or write, **Midwest Scientific Instruments, Inc., 220 W. Cedar, Olathe, KS 66061, 800-255-6638, Telex 42525(MSI A OLAT).**

MSI ..... Helping to make your business run better.



Processing Written Words

By Dennis Bathory Kitsz

Would automatic spelling correction have improved the preamble to the Constitution? Would a video screen have served better than the back of an envelope for the Gettysburg Address?

For everything there is a season, but in a world where speed of completion competes easily with quality of thought, the word processor is a comfortable native. And in a world where words have once again become a significant and accessible commodity, the microcomputer-based word processor has become essential.

Word processing is the latest rung on the evolutionary ladder of the written word. The use of written words was once the privilege of a leisure class, but the introduction of the printing press permitted the entry of the multitudes.

After enormous growth, the written word was assaulted by the electronic substitutes of radio and television. Yet written words—once on the decline after the invasion of these electronic alternatives—have become more accessible once again. In fact, they are almost too accessible.

Where photocopiers once prompted profligate duplication of words only after they had been painstakingly arranged and prepared, word processors permit—nay, encourage—draft after undistinguished draft in advance of a final (probably still undistinguished) result. Individually typed form letters now seem to gain an incongruous air of human communication when, in fact, they remain impersonal churnings of greater corpora.

On the other hand, under the command of skilled writers—many of whom prefer to differentiate their process by calling it "text editing"—verbal composition becomes surprisingly fluid and non sequiturs disappear, because the efficiency of electronic cut-and-paste has replaced the hand-scrawled and dutifully typed drafts which made revisions a major and discouraging task.

Automatic spelling correction is here, and electronic over-the-shoulder checking of syntax and agreement is not far off. Where none were conceived a half dozen years ago, serviceable word processors are already available for a few dollars. And for a few hundred dollars comes superior, convenient text editing.

How do word processors make writing easier, and what makes up a good word processing program for a microcomputer?

Error-free entry of text—Ugly strikeovers and cross-outs give way to simple backspace correction, on screen. Missing letters can be inserted, transpositions reversed, and minor mistakes removed with a few keystrokes. The fastest typists need never lose a letter.

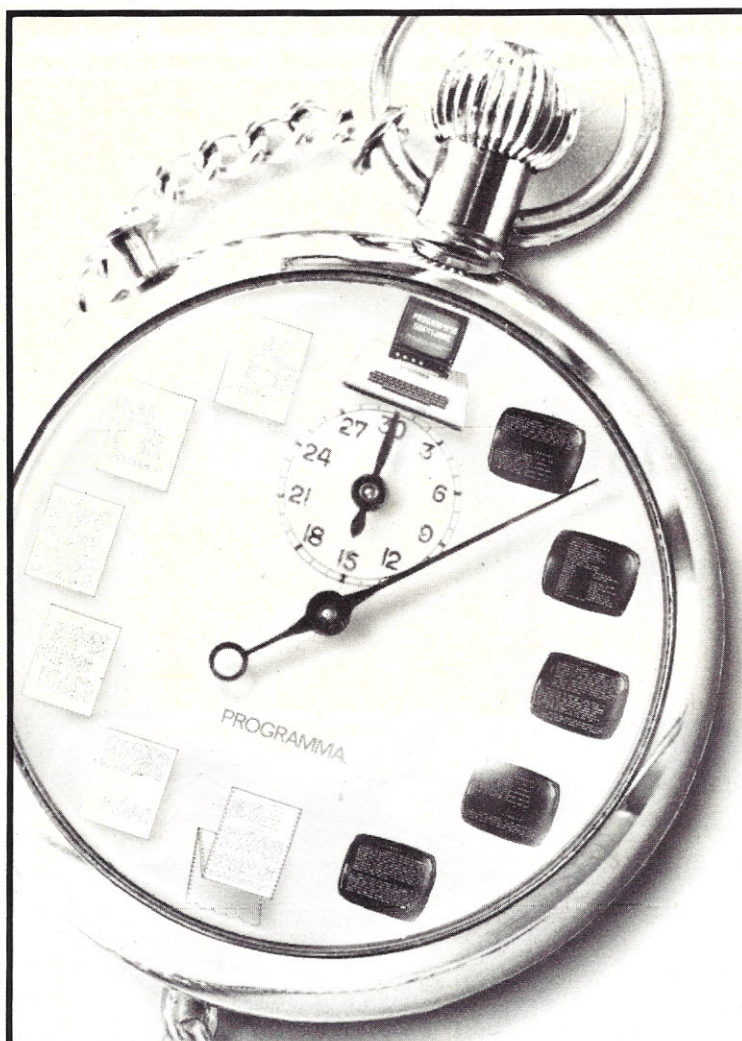
Powerful editing—Letters, words, paragraphs and large blocks of text can be inserted or deleted. Notations in the margins of handwritten drafts can be replaced by the immediate insertion of changes, or the incorporation of several versions of an idea. Phrases and thoughts can be moved, reordered and duplicated. The real power of word processing comes from the extensiveness of these editing options, and the fluidity of their use.

Storage and retrieval—Drafts, changes, thoughts and alternative versions can be stored on disk or tape, to be recalled in any order. Charts and tables created by other means can be called up and incorporated into the text, and the complete result saved. The paper draft is reserved as a last act of verbal communion with colleagues.

Drafts and final copy to any taste—Any format can be selected: single, double and multiple spacing; text justified to the left or right or both; boldface text and underscoring; centering, heading, page numbering, footnotes; subscripts and superscripts; even, depending on the printing device, a change of typeface anywhere in the text. Alternate versions can be prepared for different audiences, each letter-perfect.

Advanced features—Spelling correction, automatic hyphenation (to prevent rivers of white running through technical text, for example), automatic preparation of mailing lists and labels, cross-checking with extant data bases, etc.■

Dennis Bathory Kitsz, Roxbury, VT 05669.



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Our WPS consists of two superior programs, Apple PIE (Programma Improved Editor) and FORMAT. PIE is a free-form, live-screen-oriented editor, for creating and editing text for processing. The commands let you enter or alter anything, anywhere on your screen. You can search and replace, add, delete, move, or insert, by character, word, line or paragraph. And you know what's happening, as you see it right on the screen. PIE also allows use of a lower case adapter, and can even be used as a software development tool.

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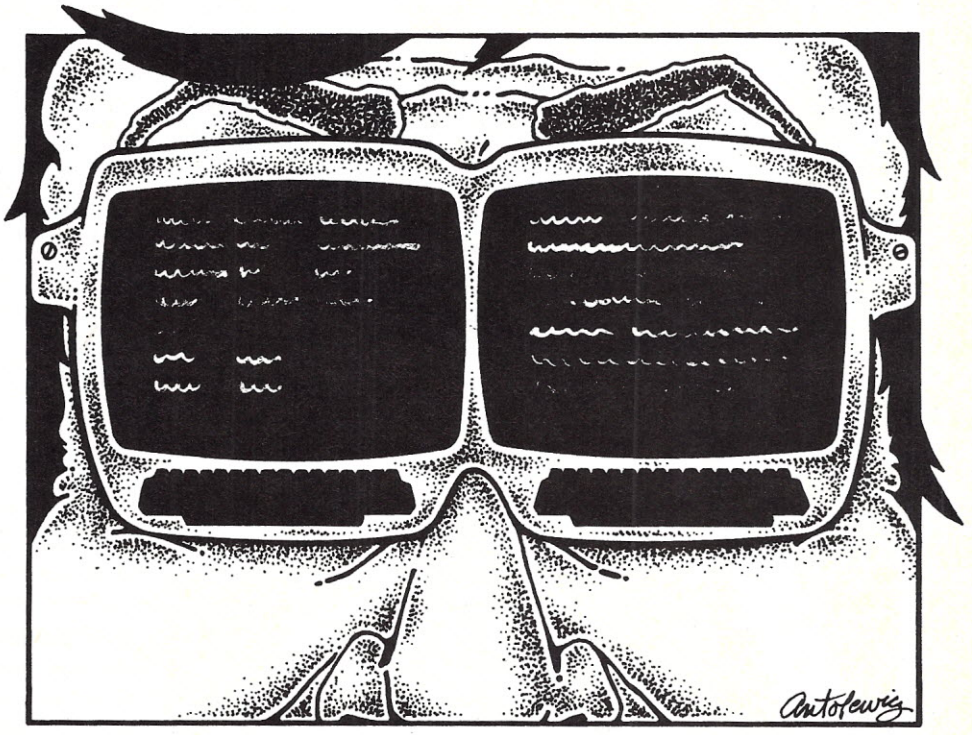
* Apple II is a trademark of Apple Computer, Inc.

See List of Advertisers on page 242

With a little help from a friend, this writer now reaps the rewards of a computerized small business.

In Search of The Processed Word

By Craig Anderton



The marriage of microcomputers and small business appears to be made in heaven. Effective computing power for small businesses is no longer financially prohibitive; the microcomputer revolution took care of that.

Or has it? I thought it was about time to find out, because if any small business needed a good dose of computerized efficiency, mine did.

I write. My work load includes three monthly magazine columns with an average length of four typewritten pages, two additional bimonthly columns, frequent one-time articles and feature articles for a variety of magazines and an average of one book per year. To complicate matters even further, I also write ad copy for CAVE Grafix, a West Coast ad agency.

A word processor, I thought, would boost my efficiency and productivity.

Many other authors are undoubtedly considering the same route, and would like some guidelines. Unfortunately, while many articles have been written about word processing systems, most are by computer users who happen to do some writing. Few are by those whose living depends not on the printed circuit but on the printed word.

The purpose of this article, then, is to show the steps involved in creating an industrial-strength word processing system from a working author's point of view. I'll then evaluate the usefulness of that system.

This should not only show other writers what's involved in taking the word processing plunge, but should also help computer store owners and system assemblers who want to understand the system requirements of a full-time author.

The Writing Process

The process of writing is much more complex than sitting down at a typewriter, creating a few pages of text, sending them to a magazine and waiting for the check to arrive. Most authors—and that certainly includes me—go through several steps to prepare a finished manuscript.

First comes an outline, the road map of an article. Then comes the first draft, where you flesh out the outline with text. Since few people get things perfect on the first try, the next step involves editing the first draft to eliminate redundancy and errors and to make the text flow as smoothly as possible.

At this point, the edited text is retyped; if all is well, this then becomes the final draft, which is sent to the magazine. However, new ideas will

Craig Anderton, c/o Microcomputing.

often surface a few hours or days later, which may necessitate yet another rewrite.

Word processing can eliminate all that retyping. You simply enter the rough draft into the computer and do all your editing on the CRT monitor. After polishing the rough draft, you can save the text in memory and come back to it a few days later to make any final changes. When all the editing is finished, simply turn on the printer and you have a finished manuscript—without the tedium of typing all those different drafts.

After realizing that this would probably save me time in the short run and money in the long run, I began my search.

The Requirements

I wasn't kidding about needing to become more efficient. My work load would tax the flexibility of any word processing system, since it must be able to accommodate book-length manuscripts, medium-length articles and many short pieces of text for ad copy. Oh yes, and sometimes I have to write form letters when sending out press releases to promote some new book or seminar.

As my requirements might indicate, trying to bash out this many words on my faithful IBM Selectric was getting to be quite a chore. Since I was starting to feel as if I was an extension of the typewriter keyboard, the only hope for salvation seemed to be a good, versatile and hopefully not too expensive word processing system.

Commercial Systems

This part of the search ended abruptly with the discovery that a commercial word processing system capable of doing what I wanted would set me back about $15,000!

While I was prepared to spend a considerable sum on a word processor, this willingness was predicated on the idea that computerization would increase my productivity to the point where the system would pay for itself in a short period of time. $15,000 seemed as if it might take forever to pay off.

I also looked at compromise measures, such as the IBM and Olivetti intelligent typewriters. However, these turned out to have limited abilities for managing and storing text. If your work consists of writing one- or two-page form letters or contracts and changing a few words here and there, they'll do just fine; but to handle books, ad copy, articles and press releases you need something more versatile.

Fulfilling My Requirements

Next, I looked at inexpensive microcomputer-based systems that cost $2000–$3000. For this I could get a TRS-80 or equivalent microcomputer, a printer like a converted IBM Selectric and cassette storage.

At first, the typical 15 characters per second of a converted Selectric seemed fast enough; after all, that's a lot faster than I can type. But then I borrowed a friend's IBM Composer, which also moves at about 15 cps. It seemed like it took forever to spit out a printed page of text. While this wouldn't present a problem for running off short manuscripts, I pictured myself getting old and gray while waiting for the 100th page of a novel to shake itself loose from the printer. So the idea of a converted Selectric, or anything else in that speed range, was out.

That left two printer choices: daisy-wheel or dot matrix. While I liked the speed of the dot-matrix type, my work requires much interaction with editors and publishers; I needed print quality close to that of a conventional electric typewriter. It's understandable why these people don't necessarily like working with pages and pages of dot-matrix print; having to read too much of it does seem to strain the eyes a bit. [Hear, hear!—the Editors.] So I checked out a Diablo printer, liked the print quality, saw just how fast 45 characters per second really was, and decided that it was fast enough for me to live with.

But I also had to come to grips with the fact that the printer alone required several thousand bucks, which is what I had expected to spend on the system. And things were just getting started.

By now, the search had become serious enough so that I needed some professional help in choosing the system hardware. I was fortunate to be able to pick the brains of Bill Godbout, who took virtually all of the technical burden off my shoulders. (Much of this is because he's a nice guy, but since I write copy for his ads, he probably also saw that my word processor would cut the time required to generate the copy and therefore save him production costs.)

If you're an author who is not into digital electronics, having an adviser is one of the most important parts of assembling a system. Many computer stores, by the way, have people who know enough about the field to serve this function and get you what you want. Your part of the deal is to be able to define your requirements clearly enough so that they can match your needs with their hardware.

Well, the Diablo printer took care of hard-copy output. What about storing all this text that I would supposedly be generating? After checking out cassette systems, it seemed that disks were the only storage medium that was fast and easy to access. Considering that this system was supposed to help me make bucks, anything that could significantly increase the overall speed of operation was worth the extra cost. Bill suggested a Morrow Discus, in the single-sided, dual-drive configuration. Again, this cost me more than I had anticipated; but I needed memory that could store a book, and disks were the answer.

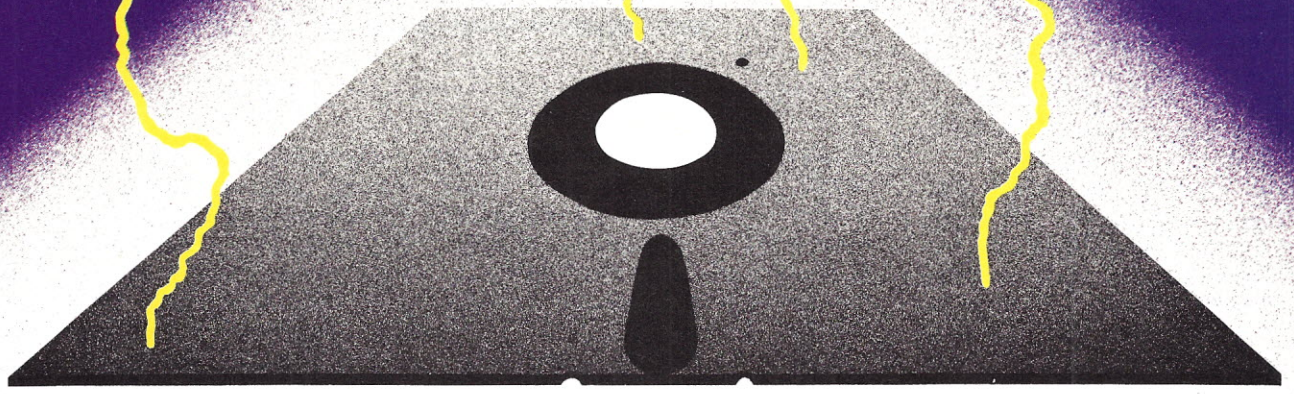
"If you're not into digital electronics, having an adviser is one of the most important parts of assembling a system."

Choosing the Computer

After looking over the field, all signs pointed to an S-100 system. Once considered an endangered species, S-100 systems have bounced back with remarkable vitality, due in large part to the proposed IEEE standard.

I realized early that any machine would necessitate trade-offs; it's just that the S-100 types made the trade-offs that I wanted. For example, when looking over possible software, Bill pointed out that software approaching my required degree of sophistication needed a lot of system RAM, more than some computers were capable of addressing. That nar-

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The author's word processing system; it's "a hefty tax deduction."

(Photo by Vesta Copestakes)

rowed down the choices right there.

I also had to consider whether I could upgrade with ease and efficiently deal with downtime. The S-100 bus helped in both respects (as a matter of fact, in the short time that I've owned my system, the CompuPro Z-80A CPU Board has already been upgraded to their new 8085 single processor board, which will eventually turn into the 8088 dual processor version).

After seeing the amount of time you save by running a 4 MHz word processing system as opposed to a 2 MHz system, the ability to upgrade IEEE-compatible S-100 computers to 10 MHz (and higher) system clocks also appealed to me. Remember, throughput is the key to justifying the cost of a system like this; any way to cut the time of memory saves, searches and the like meant money in my pocket.

At this stage of the search, an important difference between commercial word processors and do-it-yourself micro-based systems began to dawn on me. While the commercial word processors use computers, you generally can't play with the computer directly. On the other hand, by employing a general-purpose S-100 machine and using it for word processing, I still had a computer to play with and learn about when I didn't feel like bashing the keyboard (my next contemplated purchase is the Sorcim Pascal/M software package to get involved in computer languages). If I needed to do accounting or tax work with the computer at some future date, a good general-purpose machine would handle it.

The clincher on choosing an S-100 system came when Bill gave me favorable prices on the various CompuPro boards required to put together the system, which helped keep the cost of the computer down to a manageable level. The boards I originally chose for the machine included an Econoram XA and Econoram XIIIA (later traded in for two of the new RAM XX series), Interfacer II I/O board, Z-80A CPU board and a Morrow Disk Jockey 2D/B board to handle the Discus. These were all housed in the Godbout computer enclosure with integral power supply, which made for a compact and attractive package.

The Final Steps

With a decision made concerning the printer, disk drive and computer, only the terminal and software remained.

I was lucky that Bill found out about a terminal called the Visual 200. It has worked out well, and includes one feature which no word processor should be without: a detachable keyboard. Having read numerous reports that people who spend hour upon hour at computer terminals suffer from various minor (and sometimes major) medical complaints, I was determined to get a terminal that was as painless to use as possible. At least for me, a detachable keyboard is a large part of the answer. I'd advise keeping the monitor considerably back from the keyboard, so that the screen is around two to three feet away from your eyes; that way, the characters are still legible, and you don't have to twist your neck into a pretzel to get a good view of the text.

Other recommendations include: tilt the screen slightly upwards in order to provide a head-on view of the characters; don't spend too long a time at the terminal without doing some other activity (I punctuate long writing sessions with an occasional walk); stare off into the distance periodically to keep your eyes from getting fixed to a single focus point; and maintain good posture as you type. Always remember to adjust the terminal and keyboard to suit your posture, not the other way around.

The Software

The technical crew at Godbout's strongly recommended MicroPro's Wordstar. At the time, it was the most sophisticated word processing software available. Some people now say that Magic Wand is better, and I'll probably want to check it too sometime in the future. But in the meantime, I'm more than satisfied with Wordstar.

Wordstar has several very useful features. For one thing, while writing ad copy, I can have a file for each product (in fact, there are usually several files on each product—long versions, short versions, versions written for dealer publications and so on). I can then create an additional file for a specific ad, and call up the various product files needed to make up a complete ad. It's easy to insert changes (such as price fluctuations), and when the process is complete, I have a file on disk for each ad as well as the original files on the various products.

There are also other advantages to word processing that I didn't see at first, but which have proven to be very useful. When typing articles on the typewriter, I couldn't use carbon copies (I'm not that great of a typist), so I'd end up having to make several photocopies of manuscripts—say, one for my records, one for the editor and perhaps a courtesy copy for someone else. With the word processor, the printer simply prints out a few extra copies.

When writing a book, one of the biggest problems is the index. Normally, this involves searching through every page and making a note of where various words occur. With a word processor's search ability, you can enter the word you want

to index, and the computer will show you where it occurs at each point in the text. This simplifies indexing so much that it's almost worth putting everything on disk just to allow easy indexing.

"Becoming comfortable with computerized word processing techniques shouldn't take longer than a few hours of concentrated practice."

Installation Day

After several delays (first, the CPU board wasn't ready; then, the disk drives weren't ready), the hardware collection was complete. It was time to get the system up and running.

To make sure that I didn't blow everything up, and lured with the promise of an exquisite dinner at the local French restaurant, Bill came out to do the installation himself. Being experienced in analog electronics, I patiently watched him set everything up and waited to see what would go wrong. To my amazement and delight, the system worked almost perfectly from the instant it was plugged in. (Later work would reveal a flaw in one of the memory chips; since I had gotten a prototype board hot off the test bench in order to get the system going as soon as possible, it had not been subjected to all of the CompuPro quality control measures. The board was exchanged for a completely tested one and all was well.)

My next real big surprise was that it wasn't at all difficult to become acquainted with Wordstar's operation. The software is set up so that it defaults to the most common margins, line spacings and so on. As a result, after mastering a few current commands and learning how to add and delete text, I was on my way. I had envisioned spending weeks studying the manual, running into problems and having strange and unexplainable glitches occur from my lack of familiarity with the software; nothing could have been further from the truth!

What's more, you can grow with the software. I'm still learning some of the more subtle commands and print formatting instructions. It's like learning to play the piano: you can sit down, start hitting keys and get sounds, but proficiency requires a certain amount of practice.

After a couple weeks of getting the basic commands under control, I started branching out into the hard stuff such as block moves, reading files into other files and the like. It's quite clear that a lot of work must have gone into developing software of this complexity, which makes me feel a little better about the Wordstar package's high price.

I have one gripe about the software, though. In some cases, I didn't like the default settings chosen by MicroPro (for example, Wordstar assumes that you want justified text unless you tell it otherwise). As a result, if you want to change these defaults, you have to initialize a bunch of parameters before you get the system going. Unlike some other word processing software, these parameters are unfortunately not stored as part of the file; this can lead to extensive initialization. It's easy to change the Wordstar master back-up disk so that it defaults to parameters of your choosing, but MicroPro does not include this information with their software package, and in fact charges you about $100 extra for a sheet that tells you how to change the defaults. To me, that seems like poor product support when you're paying half a kilobuck for software.

It took no time at all to figure out the disk drive, and the printer only required a bit more practice to figure out how to make it work properly. All in all, unless you have a mental block about machines, becoming comfortable with computerized word processing techniques shouldn't take longer than a few hours of concentrated practice.

Does Word Processing Save Time?

In a word, yes!

In some respects, though, editing can be a little tedious. If you have to correct one bad letter in the middle of a word, it may require several keystrokes to do so (backspace, insert

FREE your keyboard — interact directly with the screen. Why waste time typing? Use a **3-G Light Pen.**

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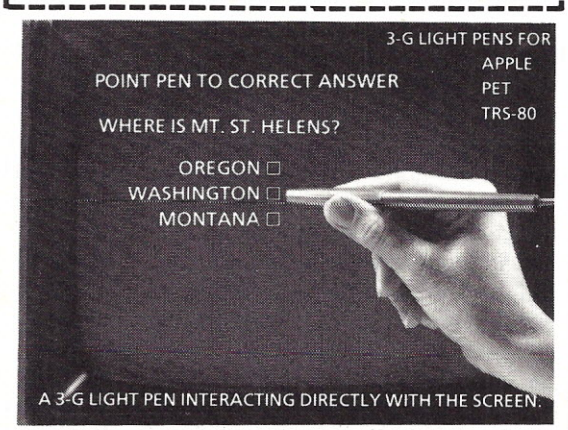
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A 3-G LIGHT PEN INTERACTING DIRECTLY WITH THE SCREEN.

new letter, delete old letter, change cursor to where you were before you did the correction). While corrections aren't always this complex, the point is that grabbing a pencil and making changes to a rough draft is generally easier.

However, if you need to make extensive changes such as deleting a line of text, moving several sentences around from one place in the manuscript to somewhere else, correcting the spelling of a word that is misspelled several times throughout the text or making repeated re-edits on a piece of "problem" text, the word processor beats regular editing in ease of use and time saved. Overall, I'd have to say that my editing speed has increased.

What saves the most time is not having to retype all those drafts. Thanks to this, manuscripts that used to take me four hours to prepare are now completed in under two hours. Time is money, of course, but time is also the luxury of relaxing, enjoying hobbies and socializing. In this respect, the word processor has had a liberating effect on my personal life, and that alone justifies its cost.

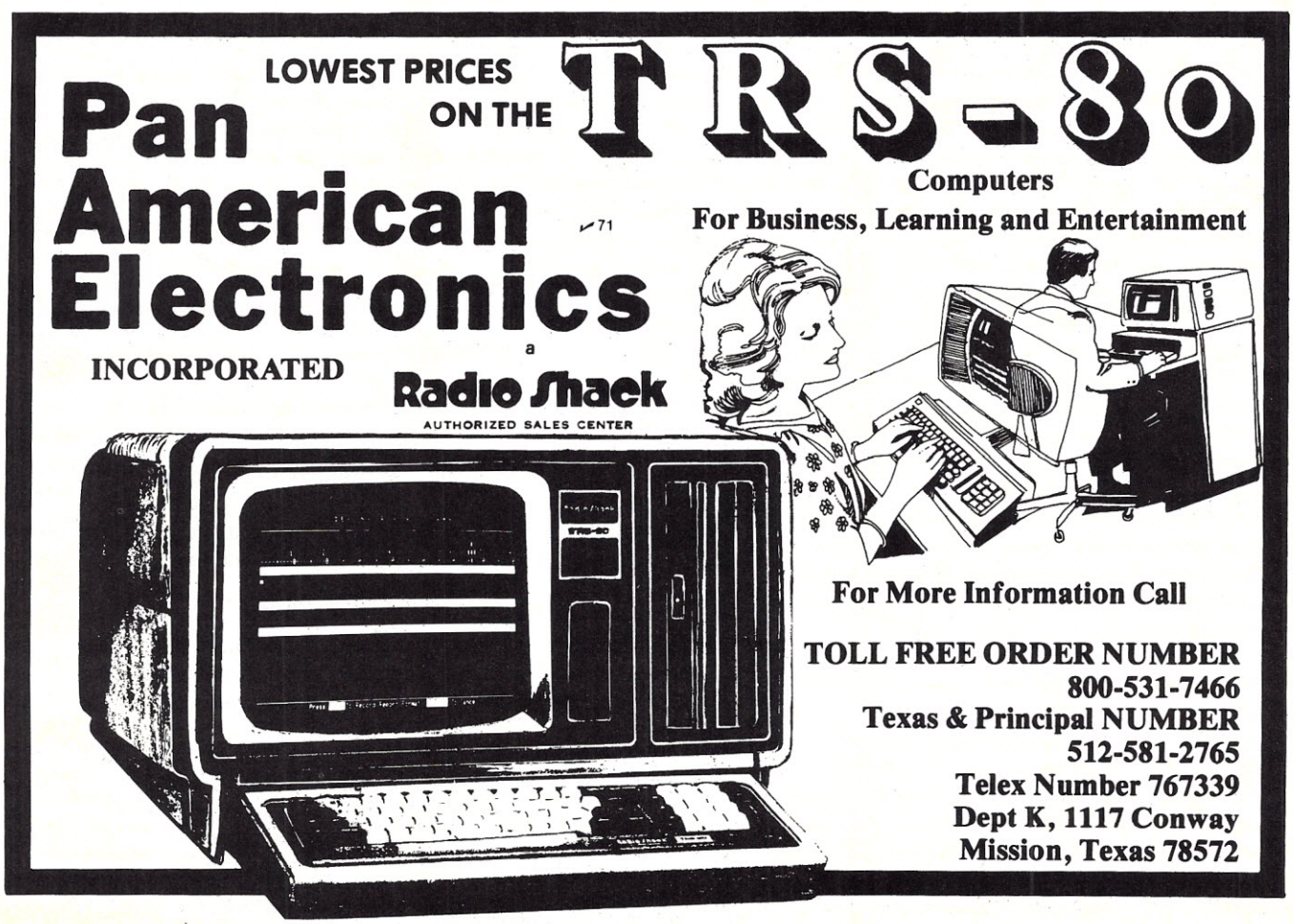
One advantage I had not anticipated was that having a word processor has improved the quality of my work. I've always considered myself a pretty good writer, but in many cases carrying a draft to the third or fourth generation didn't justify all the work involved. With the editing abilities of a good word processor, it's much easier to be a perfectionist: simply avoid printing anything until you're completely satisfied with the manuscript.

Was It Worth the Cost?

Whether or not a word processor with this degree of sophistication is necessary for your business will, of course, be dictated by your own situation. If you run a legal office, publicity service or real estate company where you're mostly dealing with form letters and contracts, a system like this is probably overkill. But after having this particular hardware/software combination in operation for a while, I feel that I certainly couldn't have gotten by with any less. It has made the process of writing more enjoyable, which is an important fringe benefit; it has also saved a lot of time and significantly increased my overall productivity.

If this kind of system sounds good to you, remember that you can't skimp on anything. Figure on about $3000 for the printer, $1400 for the terminal, $2000 for the disk drive, $2600 for the computer and about another $1000 for software, disks, paper and other supplies. Sound expensive? Well, yes. But, you're getting performance that's pretty much equivalent to commercially available systems costing up to twice that much. You've also got a hefty tax deduction, more free time, more output and the feeling of having graduated from Gutenberg's movable type to something a little more 20th century.

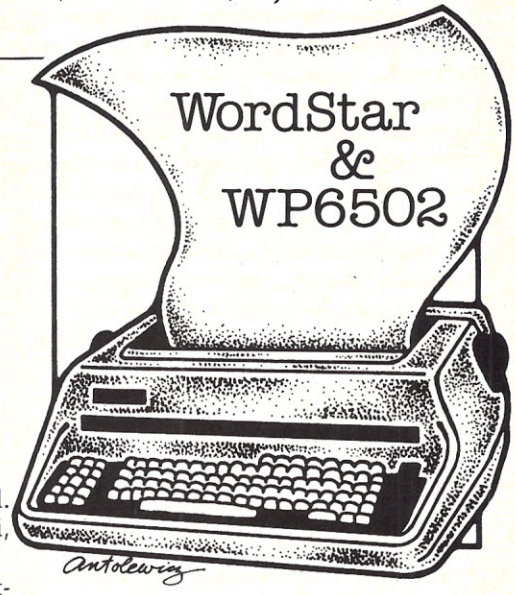
Oh yes, this article took me a little over six hours to write and edit—about half the time it would have taken on an electric typewriter. I'll clean up shop while the printer prints out three copies (one for me, for the editor, and a courtesy copy for Bill), and then I think I'll take a nice, long walk.■



See List of Advertisers on page 242

Test-drive both the Cadillac and the Chevy of word processing systems, and decide for yourself if the luxury is worth the price.

Hot Rod Word Processors



By Charles Platt

The word processing choice keeps getting harder. It has become almost impossible to keep track of the growing number of different programs, with their bewildering variety of capabilities and compatibilities. The small-business owner and computer user who wants to do word processing is liable to be confronted with a perplexing range of text-shuffling techniques, keyboard routines and command codes, available at often intimidating prices.

Two programs from opposite ends of the spectrum will illustrate how wide the choice has become, measured in terms of differences in price and design philosophy.

Wordstar is, in a sense, the Cadillac of word processing. It comes with a lot of options, it requires a lot of memory, and it costs a lot of money. (The last price I saw was $450, which buys nothing more than an eight-inch program disk and an instruction manual.) You can only use Wordstar if you have CP/M. You also have to have a serial video terminal, as opposed to a video monitor.

Wordstar will run on many small-business computers, and equipment such as TRS-80, Ohio Scientific C3, Exidy Sorcerer and Heathkit, provided the above conditions have been satisfied. I regard Wordstar as a no-expense-spared "luxury program."

By contrast, WP6502 could be called the Chevrolet of word processing. Marketed by the unlikely-sounding Dwo Quong Fok Lok Sow of New York City, WP6502 is simple to operate, comes with a basic minimum of options, costs only $100 on disk (a tape version is available for $50) and requires very little memory. The program can be used by anyone who has any model of Ohio Scientific computer, with or without video terminal. Variants are forthcoming for Atari, Apple and PET.

Recently I had the chance to test-drive both Wordstar and WP6502. The results were instructive.

Wordstar

Wordstar's enormous range of command options, for editing and reformatting text, creates a formidable first impression. In fact, there are so many options that five separate menus are required to display them all.

The first menu lists the keys which must be pressed to move the cursor and perform simple delete functions; this menu occupies the top one-third of the video screen and is constantly displayed (text scrolls beneath it). To display one of the other four menus, you type a command code to retrieve it from disk. There is a pause of a few seconds. Then the old menu is erased and the new one takes its place. You can then inspect it for further instructions regarding global editing, resetting the margins, or whatever.

The cursor is controlled via four typewriter keys in conjunction with the control key. Letter E moves the cursor up, D moves it to the right, S to the left and X downward. The visual placement of these keys on the keyboard corresponds to the respective directions of movement which they control, but this fact is of little use to touch typists, who don't look at the keyboard while they work and may find the choice of letters arbitrary. To add to the possible confusion, there are additional code commands (using nearby keys, easily confused with the first set) to move the cursor across the screen in a series of jumps, pausing at the first letter of each word; or to move it in one leap from the beginning of a line to the end of that line; or to scroll the text up and down while the cursor remains stationary.

Text appears on the screen as fast as you can type it, and the program senses when a line is full and automatically starts a new line for you, though there is a disconcerting flicker and jump of the image as this occurs. If you wish, Wordstar will add spaces between the words of each completed line of text, filling it out to full column width. This reformatting is quite quick and is controlled by commands specified on one of the other menus. If you try to specify a very narrow column, it may not accommodate some of the longest words in the text. These words will have to be broken and hyphenated, and the program features a routine which allows you to do this.

Whatever format you choose for the text on the screen, this is the same format you will get when the text is printed out. Wordstar thus lets you inspect and approve the appearance of your work, as you type it, before it ever reaches paper.

The WP6502

Let's go back to WP6502 for a moment to see how some of the same functions are achieved in a simpler fashion.

Whereas I used Wordstar on office equipment with 64K RAM, a good video terminal and dual eight-inch disk drives (total system cost about

Address correspondence to Charles Platt, PO Box 556, New York, NY 10113.

$10,000), WP6502 was run on a Challenger C4P MF with 24K RAM, one five-inch disk drive and a modest video monitor. The 24K RAM is sufficient for most simple applications; it lets you type about 2000 words before having to stop and save the text on disk. Total system cost in this case was slightly under $2000. (You could assemble an even cheaper system, using a tape-driven C1 Series 2, a cassette recorder and a domestic TV set. This would give you real word processing for under $600. But I'm assuming that any serious user of word processing will want the flexibility and speed of a disk system.)

Incidentally, none of the above prices includes a printer.

When you use WP6502, its menu appears on the screen, listing just a few basic options such as Type, View, Line Edit, Global Edit and File. You select an option by pressing an appropriate key letter. For instance, if you want to type, you press T. If you want to do a global edit, you press G. This coding is obviously easy to learn and remember.

When you select T and start typing, the text that you enter begins filling up the bottom of the screen and the menu moves up out of the way to make room. (The menu can be instantly retrieved and displayed at any time—from memory, not from disk—by pressing the Return key.) WP6502 starts you on a new line automatically, whenever you need one, and it performs this automatic line feed almost instantaneously. The whole program is written in machine language, so all its operations are extremely fast.

WP6502 does not give you the ability to fill out and justify lines of text on the screen or on paper, unless you are willing to spend an extra $50 for the justification package. Even then, WP6502 will not reformat the text while you are typing; you have to stop typing and go into the view mode in order to see the justification. This is a small inconvenience, however, and the justification of the text when it is printed out on paper is just as professional as Wordstar's in appearance.

If you make a typing error while in the Type mode, you can wipe it out by backspacing over it and retyping. The rubout key on the Ohio Scientific keyboard is used for backspacing—it's located where a typewriter backspace key would normally be.

Incidentally, WP6502 automatically normalizes the Ohio Scientific shift key operation, so that the keyboard works like an ordinary typewriter, without any surprises. And the standard Ohio Scientific upper and lowercase text display is decently legible; you don't have to plug in any special video boards, as you must on some other brands of computers.

If you want to correct an error on a previous line in the text that you're typing, you have to go into Line Edit mode. One keystroke accomplishes this. You can now scroll your text up and down by means of the line feed key and the control key, and you move the cursor right and left by pressing either the space bar or the rubout key. In the Line Edit mode the cursor is nondestructive—it passes over the text without altering it.

When the cursor marks the part of your text that you want to alter, you press D, I or R to delete, insert or replace text. Pressing D takes out one letter; if you then press W, this removes the rest of that word. If, instead, you press S, you take out the rest of that sequence. The text reformats to absorb these changes immediately. Insertions, also, are done quickly and easily.

While you are in the Type or Line Edit mode, WP6502 displays your text in single-line spacing only, within fixed margins. It does not let you display paragraphing, tabs, double-spacing and so on. However, you can insert embedded commands which will produce layout effects when you subsequently go into the View mode or print out your text. An embedded command consists of a # followed by a code letter. For instance, to insert a paragraph you type #P. To indent the margin by ten spaces you type #M10. It's an inconvenience being unable to see the effects of these commands as you type them, but it's something you soon get used to, and you can easily see the layout any time by pressing return to get back to the menu, then V to go into View mode, where the text is instantly reformatted to appear as it will when printed out.

WP6502 has a couple of additional features which save a lot of labor. If there's something you want to alter buried in the middle of a large lump of text, you don't have to scroll through laboriously looking for the error. You select the Line Edit mode and then type in a word or words that identify the piece of text you want. The program then finds it almost instantly, and commences the Line Edit display at that point.

This is a similar operation to Global Edit, where you specify a character string and then specify a second string that you want substituted for the first, anywhere that the first string appears. Both Wordstar and WP6502 offer this feature, and both let you inspect and approve or cancel each substitution of new text before it is irrevocable.

A Comparison

How do the two programs compare? There are some economies in WP6502. Its on-screen reformatting is limited compared to Wordstar. You can't fiddle around with the lay-

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out and margins as easily, you can't see the layout at the same time as you type your text, and you can't do hyphenation. Also, Wordstar lets you print out one piece of text at the same time you are writing another piece of text; WP6502 doesn't.

On the other hand, WP6502 is easy to learn, simple to use, very modest in its equipment requirements and it has some surprisingly sophisticated abilities. It has a very elegantly designed Block Text system, for instance, letting you set up as many as 99 numbered text blocks which can be retrieved in any sequence, as many times as you like, and mixed with other text. The blocks are called in by typing their identifying numbers as embedded commands (#B01, #B02, etc.) in the text. This lets you, for instance, assemble a new business letter from standardized paragraphs. The end result looks custom-designed for the recipient but takes only a few seconds to put together.

WP6502 also offers a special command that will interrupt printout and let you insert special text from the computer keyboard. So you can type in an individual name and address on a form letter, then let the program print out the rest of that letter.

Which program is better—WP6502 or Wordstar? The comparison is not necessarily meaningful, because the programs embody such different design philosophies. Certainly Wordstar has more options and is very versatile. But you pay for this luxury, in the higher price of the program itself and the expensive hardware needed to run it. Some people may also feel that the versatility of Wordstar has its disadvantages—there are perhaps too many command codes to learn, and too many menus to consult, until you eventually memorize the whole system.

In the end I have to go back to my automobile analogy: Wordstar has the same appeal as a Cadillac. It offers you every option you can think of, and a couple you forgot, at a relatively high price.

WP6502, like Chevrolet, performs many of the same functions more austerely and with less frills.

But the analogy doesn't stop there. Just as Chevrolet has introduced their own special luxury models in the past few years, WP6502 has now started to offer more options, bringing it closer to the Wordstar capabilities, though still with the same modest equipment requirements and a price which, though higher, is still reasonable.

Specifically, WP6502 now comes in two basic versions. Version 1.2 has been considered in this article; you can add to it the justification package, a disk-file management system (which is a great help in setting up and organizing files in which to save your work on disk) and a couple of other neat enhancements.

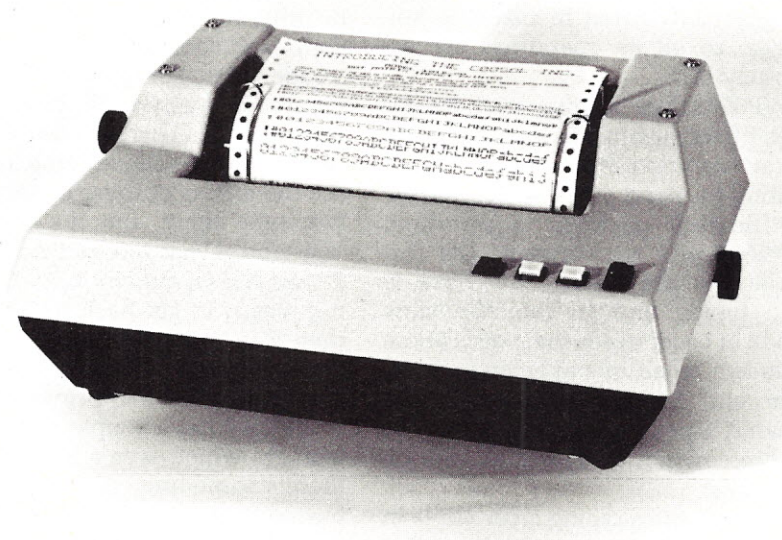
Version 1.3, recently released, includes all these options as standard, also includes a computer memory test and a disk-drive test for good measure and offers refinements of the Line Edit and View routines which make program operation even faster. The cost of Version 1.3 is $250. Both versions will continue to be available.

As I said at the beginning, the word processing choice becomes more and more bewildering all the time. ■

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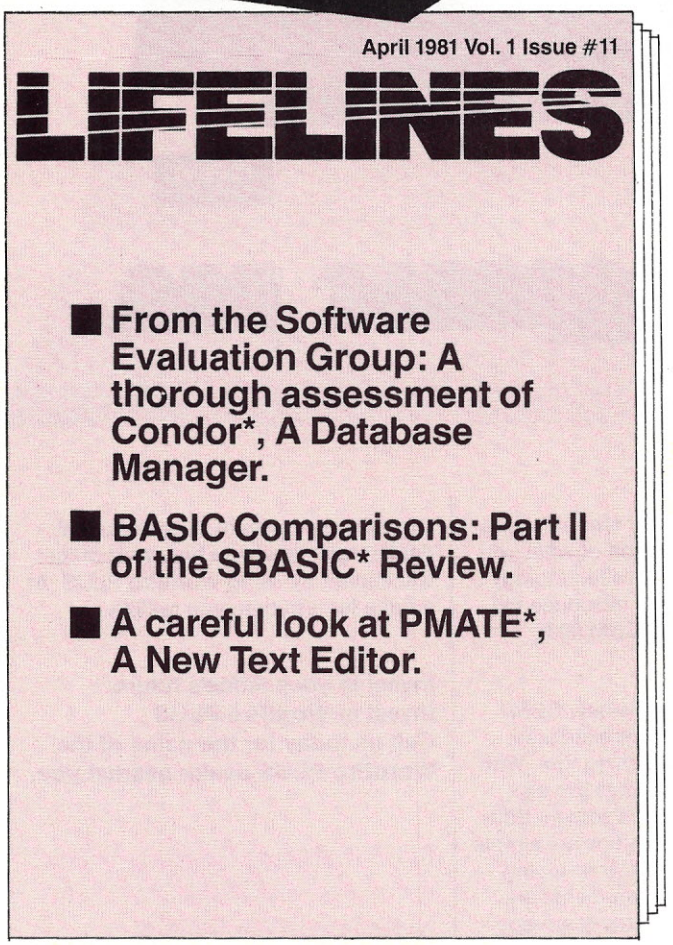
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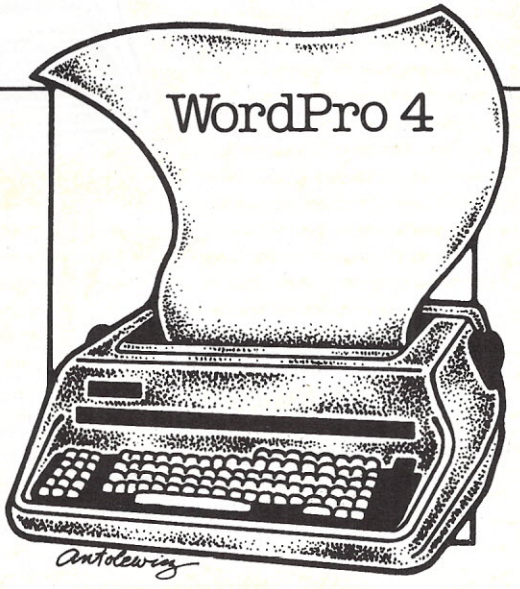
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Word Processing Roundup

By Reese C. Fowler



WordPro 4 Plus from Professional Software, Inc., is a state-of-the-art word processor for the Commodore CBM 8032 computer. When used with a letter-quality printer, such as the NEC Spinwriter, it has just about every feature that even the most demanding user could ever want in a word processor.

The WordPro 4 Plus package comes with a user's manual, a software disk and a ROM that must be installed into your computer. The software is divided into two parts, and the software on the disk will only work on the computer in which the special ROM is installed, so if you have two computers you will need two copies of WordPro 4 Plus.

The manual that is included with the software is a complete tutorial on the use of the program and will teach anyone how to use it, even if they have never used a word processor. To help the first-time user, Professional Software, Inc., has included a sheet of stick-on labels for the keys on your keyboard that will help you identify the special function keys.

Because the CBM 8032 does not have a true control key, the software for WordPro has to create one for you by changing the reverse video key, in the lower-left corner of the keyboard, to a control key. To use any of the special functions of WordPro, you must press this control key and the key for the function desired. For example, pressing the <control> and <home> keys will move the cursor to the upper-left corner of the video screen. Pressing these keys a second time will move the cursor to the first character on the first line in the file. This control key is the most important key on the keyboard.

The only feature that is missing in WordPro 4 Plus is true proportional spacing of your text. With WordPro 4 Plus, you can print boldface or underline your text for emphasis. You can even underline the boldface text if you want to. You can also print superscripts or subscripts in your text.

You enter text exactly as you would on a standard typewriter, except you do not have to press the return key when you reach the end of a line. WordPro 4 will automatically move the cursor to the beginning of the next line, and you can continue typing until you reach the end of the paragraph.

Unlike some other word processing programs, WordPro 4 does not move incomplete words from one line to another in the entry mode, due to the limited memory of the CBM 8032. When you have entered your text, you can write the file to the disk for later use. Once the text is on a disk, it can be recalled at any time.

Before you print your text, there are many options that you can select. You can go to the format part of the program and select a header or footer for every page. You can select how you want the margins set and how many lines you want on a page. After you set the format for your document, you can display the document on the video screen in the selected format. If you don't like what you see, you can change it and redisplay it on the screen until you get the format you desire. What you see on the screen is exactly what the printed output will look like, except that boldface, superscript and subscript won't be displayed. However, underlined text will be displayed in reverse video.

Once you have the format the way you want it, you should write the document to the disk. Now, anytime you want to, you can print this document exactly as you formatted it. And once the document is on your disk, you can direct it to the printer, while at the same time you can start preparing another document on the video screen.

One of the most unusual features of WordPro 4 Plus is the numerical mode, which allows you to enter columns of numbers in your text and line them up by decimal point. The program will even add these columns of numbers and print the total at the bottom. If you prepare a large amount of numerical data, this feature alone will pay for the program. This feature of WordPro 4 Plus is so convenient that several database programs for the CBM 8032 have been interfaced to it for complete reporting capabilities.

The program does have a few shortcomings. For example, you can only have about a five-page document in memory at any one time. This problem is caused by hardware limitations, not the program itself. However, the program will allow one document file to be linked to a second file, which can be linked to a third, and so on. In this way, the size of a document is limited only by the space on your disks. But to edit a long document, you have to load and edit each part separately. This problem is caused because the CBM 8032 has only 32K of memory for both the program and your text, and the program uses 20K of this memory. If Commodore introduces the CBM 8096 computer with 96K of memory this problem will disappear.

There is one other minor problem—



Word Pro 4. (Photo courtesy Professional Software, Inc.)

every time that you load the program, you have to go through the configuration routine. Once you have configured the system, the program should default to this configuration on power-up without any input from the user. It could display the current configuration and ask if you want to change anything. A no answer should allow the program to proceed, and a yes answer should call the configuration routine.■

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Spellguard



By Tony Dowden

If you ever make spelling errors, then a new piece of software to hit the CP/M business environment may be just for you. Spellguard tests the spelling of a text file (up to 20,000 words) and flags any errors for correction. This easy-to-use, operator-oriented program has saved me countless hours of proofreading, and from the embarrassment of submitting a manuscript with typos.

Unlike most spelling test programs, Spellguard is fast. It will completely and accurately test a 10,000-word file (about 20 printed pages) in less than one minute. With a hard-disk system, it's about three times as fast.

Operating Procedure

1. Put the Spellguard disk in one drive and the file to be tested in the other (they can be on the same drive, but the dictionary is large).
2. Type SP.
3. In response to a menu, which will then appear, type P (or p or 1) to bring up the proof mode.
4. Tell Spellguard the name of the file to test.
5. As it progresses, it will display the number of words read, the number of unique words in the file, the percentage of unique words, the number of mismatched words, the percentage of mismatched words and the percentage of proofing done.

As an alternative, type "SP FILENAME.TYP, and Spellguard will skip steps 3 and 4. In either case, drive number (X:) may precede the file name where required.

After the test is run, you get a chance to look at each of the words and decide whether to add it to the dictionary, mark it in the file for correction or ignore it. Selections are done with a single keystroke, either using A, M, I or 1, 2, 3.

Spellguard then automatically incorporates the "add" words to its dictionary, flags the "mark" words in the text file, and ignores the rest. Words in your text file are marked by changing the last letter of the word to an "@" symbol; however, this can be changed to the symbol of your choice. You then use the global search mode of your editor to find the "@" symbols, and change the word to its proper spelling. It also creates a back-up file, the original input file prior to the execution of the spelling test.

Extensive procedures are provided to add to the contents of the dictionary, delete words from the dictionary and review the dictionary. You can also list the dictionary on the console or the printer, allowing you to review the contents and determine whether any changes are required. It has provisions for several dictionaries—business, technical or personal.

Spellguard has been extensively tested with ED, Wordmaster, WordStar, Magic Wand, Electric Pencil, Spellbinder and other word processors, and has performed perfectly in all cases. In the event that it doesn't work with yours, Innovative Software Applications (Box 2797, Menlo Park, CA 94025) will give you a money-back guarantee. In addition, it can be easily updated to cover future software which will be introduced into the market.

Applications

The prime application of Spellguard is the testing of documents for people whose work consists of selling words on paper—the technical writer, fiction writer, legal offices, publications houses. In addition, you could create a dictionary with only programming terms like LXI, ADD, JNZ and NOP or LPRINT, GOTO, INPUT and DATA. This would be a real help to programmers whose first run of a program, especially larger ones, consists of finding errors in the source code.

Documentation

The Spellguard manual comes bound in a quality three-ring binder, and includes a pocket in the back for the disk. I found the documentation to be complete, and very well organized. A very clean approach to examples is used which helps the newcomer. I sure would like to see more manuals written like this, with the user in mind, rather than reading like poorly documented software.

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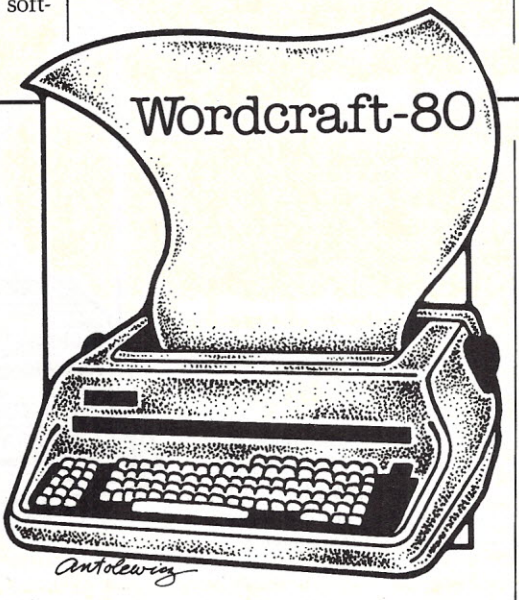
The Spellguard program has very few limitations. It currently can be used only on a computer running the CP/M operating system, although the people at Innovative Software Applications tell me that they are working on packages for other operating systems. In addition, the software requires 32K for operation.

There is no limitation on the size of the file you are testing other than that there must be room on the disk containing the original file for a back up file. It does not generate a temporary file to clutter up disk space, so files over 100K on a single-density eight-inch disk are handled easily. The dictionary file is usually stored on the second drive, and is over 130K as supplied. In addition, you should be running a CRT-type terminal rather than a Teletype-like terminal, although it will work with either one.■

Technical writer Tony Dowden lives at 974 E. Evelyn Ave., Sunnyvale, CA 94086.

Wordcraft-80

By Reese C. Fowler



Wordcraft-80 by Commodore/MOS Technology is a word processor designed to run on the Commodore CBM family of computers with 32K of memory. It is written entirely in machine language for efficiency and high speed.

Wordcraft-80 differs from many microcomputer-based word/text processing systems in that it is a completely video screen-based system. What you see on the screen is, in general, exactly what you will obtain on the printer. The printing abilities are built in, and use formatting information embedded in the text with control characters. However, these control characters are not usually visible on the screen.

Because the text formatting controls are embedded in the text, and are therefore associated with that text, the format on the screen includes a mechanism for indicating where such controls are placed. This is by reversal (black on white) of the text character immediately following the formatting control. The actual control used is usually obvious from the effect that it has on the screen display.

Wordcraft-80 provides the ability to deal with large page formats (up to 117 characters wide and 98 lines long), without losing the screen-to-printer equivalence, by scrolling the text on the screen both vertically and laterally. If you are using the program on a CBM system with only a 40-character display, when you type the 41st character all the text on the screen will scroll to the left. Similarly, when you add the 20th line of text, the screen will scroll up to let you enter the 21st line. This action is in multiple character or line increments, so scrolling is in jumps rather than in single lines or columns. It's a little unnatural at first, but you quickly become used to it and find it useful.

Also, when you reach the end of a line, the cursor will automatically drop to the next line and move any unfinished word down with it. The only time you must press the return key is when you want to end a line before the right margin is reached or to end a paragraph.

In a 32K Commodore CBM computer you will have about 12K of memory for text after the program is loaded. This will only let you have about a six-page document. To overcome this limitation, one document (or chapter, as it is called in Wordcraft-80) can be linked to a second document. The only limit is that all chapters must start on a new page of text.

The number of chapters in a document is limited only by the space on your disks. For example, the 100-page users manual that comes with the program was prepared as a single document with many chapters. Also, to save space on your disk, the text is stored in a packed format, and not as it will finally appear. Thus, the 12K bytes of memory are used efficiently.

Note that the text is stored in a coded form and not in true ASCII. This was done to speed up scrolling and page renewal operations, and is no concern to the user. However, one side effect of this is that document files produced by Wordcraft-80 require special handling if they are to be accessed by other programs.

As to features, it is sufficient to say that Wordcraft-80 is a full-feature word processor. If you want it, it is in Wordcraft-80. You can, with the proper printer, print boldface, superscript, subscript and underline your text. Your paragraphs can have different margins and line spacing. You can have a header and

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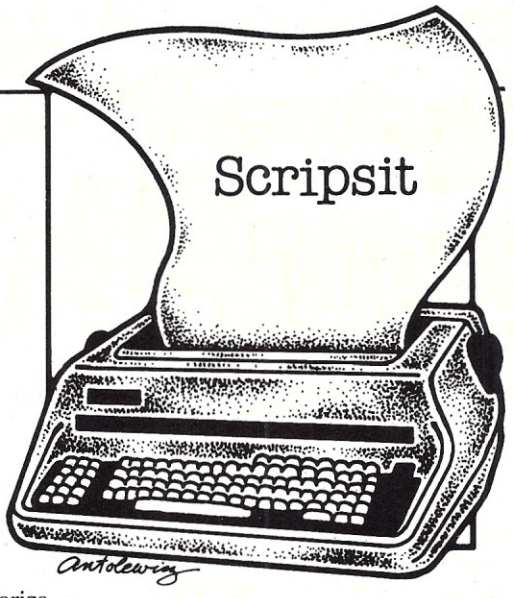
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Scripsit

By Ken Knecht



In my never-ending search for the ultimate word processor, I bought Radio Shack's Scripsit for its TRS-80 Model I.

This disk-based unit requires 32K of memory and uses screen formatting a la the Electric Pencil. The commands, though there are many, are consistent and logical, and thus easy to memorize. A set of labels marks the 16 special control keys used for deletion, insert and so on.

Scripsit's six lesson tapes come in a nice binder, and are quite good. The lessons use existing files, and therefore require little typing.

Features

The arrow keys move the cursor. You can make corrections by placing the cursor over the character and typing the new one.

Inserting a line, word or paragraph requires only two additional key presses. Deleting is also simple, and you don't have to count characters. To exchange adjacent words or paragraphs, you press only two keys.

You can easily preset tabs, either with the cursor or by typing in character positions.

Screen formatting is also easy, and you can change the format at any time with just a few commands.

If you use 8 1/2×11 inch paper, the printing defaults will probably be acceptable. You can adjust all four margins, page length, paragraph spacing, line spacing, indent and so on. One optional feature pauses the printer after every page if you are using single sheets.

The program comes in two versions, for uppercase or lowercase. It includes a printer driver routine, suitable if you have a serial printer and the RS-232C module in your interface. It works fine with my Diablo 1620.

If you have Radio Shack's lowercase modification, you can lock the keyboard into uppercase by typing shift control. Radio Shack recommends their own lowercase modification; others might not work correctly with Scripsit.

Scripsit also includes global delete, replace and find. Replace lets you quickly change up to 255 words in the text with another word. You have to watch out for case differences if you're using a lowercase machine. Changes can be done one at a time or for a specified number of times. Delete works like replace except that the designated string is deleted. Find locates one word at a time. The string you are searching for remains in memory, so you can make succeeding searches easily without retyping the string. An additional feature, the wild card search, lets you type in a ? for any character in the string you are searching for.

You can save data as you enter the text. The first time, you type S followed by the file name. Succeeding saves require only the S.

Another feature lets you use a window to view the text. The cursor is stationary while you scroll. Normally you have to move the cursor to a CRT boundary before scrolling.

Scripsit includes block markers, which identify the page header and footer and let you insert titles and page numbers. You can also use block markers to move blocks of text, delete a block of characters or exchange blocks within the text.

Scripsit includes a hyphenation feature that lets you close gaps between words in justified copy. The cursor moves to the first word of the line immediately following the one to be tightened. You insert the cursor between syllables and type a hyphen. You can hyphenate all or part of the text.

Problems

One of Scripsit's major failings is that footer on every page and right justification of the text.

I can't think of any word processing feature that has been omitted from Wordcraft-80. If you want a word processor that is easy to learn and use, you could not do better than Wordcraft-80. ■

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you can't concatenate disk files to produce a text larger than will fit in memory. You can concatenate files in memory, but you are limited to the text in memory when you print the text. You can print your files one at a time and adjust the starting page number of the first page to succeed the last page in the last file. However, if a file ends early on a page, the next file will start on a new page.

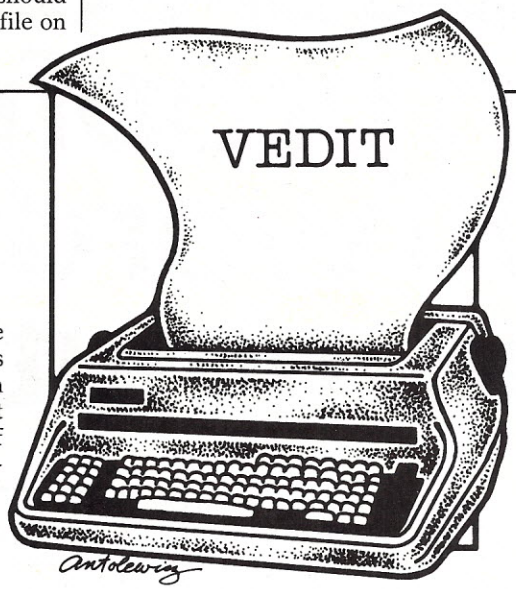
This is an unfortunate lapse in an otherwise good word processor. You should be able to continue another disk file on the same page while automatically continuing page numbers. Ideally, the additional files should be included in the file so that this would take place automatically. There may be a way to continue text on the same page but I haven't discovered it. Normally a new file printout is assumed to start on a new page. As I mentioned, you can do it by keeping the chapters short enough to fit into memory and adjusting the page number of the next file to begin with the correct number, but this is very awkward.

Also, you can't insert data from another file into the printout, such as a list of names and addresses to be included in successive form letters. You have to edit the file to change data.

These are two important features for business. Perhaps Radio Shack will add them in a future version. ■

Send correspondence to Ken Knecht, 1340 W. 3rd St., #130, Yuma, AZ 85364.

VEDIT



By Gene Head

The task of editing a source file with CP/M's ED is about as appealing to me as chiseling in stone. Some people can make that editor snap-to, but I'm not one of them. Recalling the all-CP/M issue of *Doctor Dobb's Journal* in January 1980, I remember the excitement of finding a way to convert my Pencil files to CP/M format for source file editing of assembly language, CBASIC and FORTH files. Finally, I could use a screen editor to edit files and then simply convert them to CP/M format before assembly.

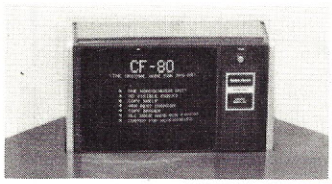
However, first converting the existing ASM file to PCL, then editing the file with Pencil, then converting back to ASM before running MAC to assemble the source code, then redoing the entire process for a simple error caused a normally long edit and assemble and debug session to be just as long, if not longer, than when the CP/M editor was used. What the world of the hacker needed, I saw, was a Pencil-like editor with standard ASCII files, to eliminate all the conversion.

I read over the ads in the magazines for an editor to suit my needs, and found VEDIT, from CompuView Products, Inc. (1531 Jones Drive, Ann Arbor, MI 48105). I called CompuView to explain my system—Imsai VIO and MIO, North Star Disk, Cromemco ZPU, home-brewed printer interface card, and so on—but they weren't very interested in my particular configuration. It later became obvious why—their software is configured by the end user.

The Editor

First, the nuts and bolts. My version of VEDIT costs $110. It can be user-configured to most CRTs, memory-mapped video displays and popular disk formats. It operates under CP/M and is available from the manufacturer or CP/M vendors such as Pickles and Trout. Prices vary, depending on special, nonstandard host hardware.

The system is customized by first running the configuration program supplied on the disk. This program runs through the standard CP/M I/O and will be executable by any CP/M system. After signing on, the user answers plain English questions about the host system and responds to directives like "press the escape key now." All command keys are also customized during this initializa-

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tion. Cursor movement, insert, tab, delete functions and all others are defined by the user. Hardware configuration is done by the same plain English prompts.

I finished in about ten minutes with only a few references to the manual for clarification. It worked the first time out!

As a software reviewer, I try to play dumb and assume nothing. I sometimes ask my 12-year-old to read an instruction to check the clarity of the manual. CompuView's manual passed with flying colors.

After initialization, I had a file called EDIT.COM that was ready to run.

The two modes of operation are visual and command. In visual, normal screen editing is done with such features as scrolling/paging, cursor control, insert/delete and TAB. The command mode offers all the features found in the standard command type editors like ED, and then some. Most noticeable to me was the extensive disk buffering and disk handling abilities. Files bigger than available memory are automatically buffered onto and off of disk(s). Multiple files are managed and can be merged on input and split on output.

The keyboard is software-buffered to keep up with the fastest typist. My George Risk $29 special still strobes out bad data every so often, but the buffering never loses track of anything. Wildcard characters are allowed in most commands and nested iteration macros are provided. Tabs can be set and reset during execution to make structured source files with needed indenting, such as might be written in Pascal or FORTH, easy to write, and thus easy to maintain and document.

Implementing the command mode took some getting used to. While it is very powerful, I was often confused during early edit sessions. But like with anything new, it just takes time to adjust. Two special features that saved me more than once—the undo command will restore all text if executed before a termination of command, and a back-up file is always maintained as FILENAME.BAK. If worse comes to worse you can always start from where you first began.

Obviously, the more powerful the package, the more time it takes to learn of all the subtle features. The difference between a cursor tab and a tab character has just recently come to light. It worked fine before, but even better now that I understand. I have yet to fully explore all of the extended commands of file merging and rewriting and file renaming —I haven't had the motivation or need. But what I've mastered has shown me what a fine piece of software this really is. As my needs expand I expect VEDIT will continue to meet them.

CompuView offers software support for $45, not a bad price for continued support. The preface in the manual outlines some specific upgrading objectives that, when completed, will certainly be worth the $45.

If you write source code, I doubt if you could find a better value in the editor market. VEDIT is clean, easy to operate, CP/M-compatible, and has many features found only on higher-priced word processors. But best of all, you can throw away the convert programs you use to change your word-processor files to ASM files.■

Gene Head, 2860 Skyline Drive, Corvallis, OR 97330, is a broadcast and computer consultant to the television production and broadcast industry. After five years with the Engineering department at Metromedia Square in Hollywood, he now writes, does software development and review and offers free-lance engineering services. He and his wife run a group care facility for abused children.

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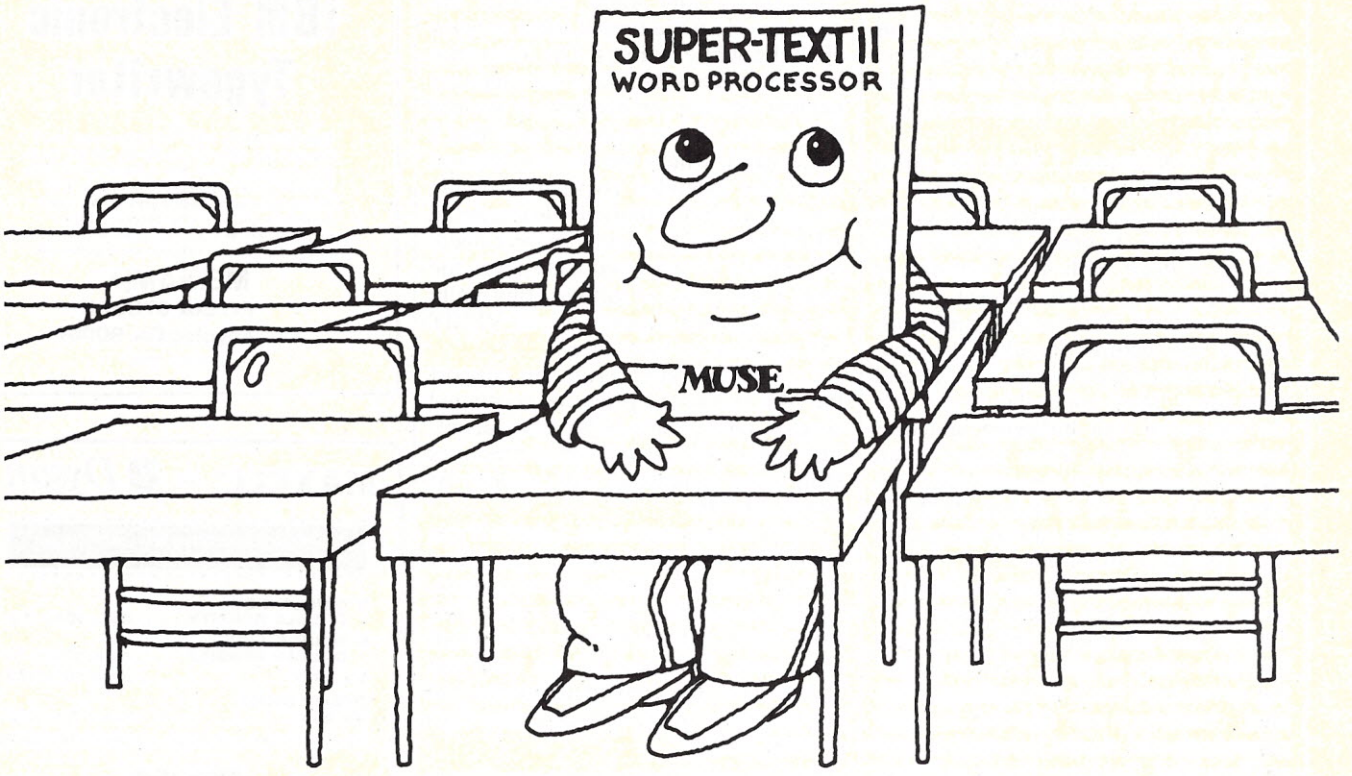
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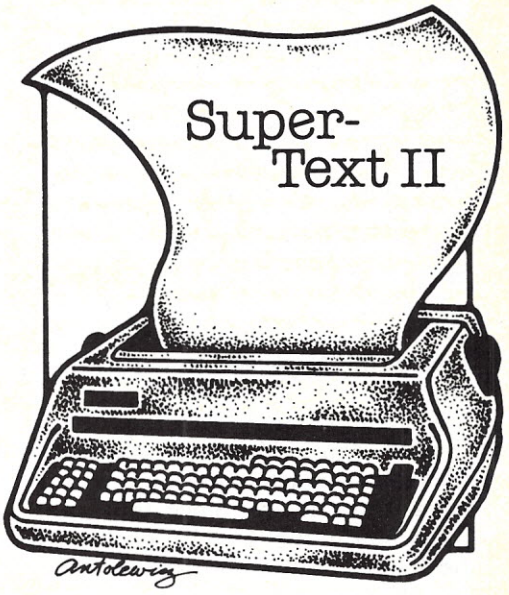
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Inspiration From the Muse



By David C. Goodfellow

Super-Text II, by Muse Software (330 N. Charles St., Baltimore, MD 21201), is an improved version of an already impressive word-processing program for the Apple II and Apple II Plus, requiring 48K RAM and at least one disk drive. This article discusses features common to Super-Text and Super-Text II, followed by improvements made in the new release. Users of the earlier version and those who have never used Super-Text will find this discussion beneficial. The article concludes with a discussion of shortcomings and a judgement of the program's overall value.

Super-Text

First, the program is easy to use. Its documentation is superb. The new user can become an expert with one or two evenings' practice.

Second, it is versatile. You can configure it to your most common printing format and let it default to that format, and you can change the format in text, with embedded commands. This gives you the best of both worlds.

Third, it is fast. It writes text to disk in binary format, resulting in faster recording and retrieval than is possible with a text file. Binary format also allows more text to be stored on one disk.

Specific features include:

- Autolink, the capability of automatically chaining files, so that a whole disk (more, if you have multiple drives) can be searched or printed, file by file, in one operation.
- An automatic "the" key, which allows one-stroke insertion of this common word while typing. This requires some getting used to, but is well worth the effort.
- A math mode, which lets the computer do your mathematics *in text*. No need to stop and figure totals. This feature also formats your numbers, so they look presentable on the page.
- An extremely fast Search feature.
- An equally fast Find and Replace. Once you have to change "widget" to "gismo" 47 times in 30 pages, you'll know how valuable this feature can be. Find and Replace lets you change all occurrences of the offending word automatically, or make that decision for each one. Used in conjunction with Autolink, it can make the change throughout all files, on as many disk drives as you have on line.
- A query function that tells you how much space you have left in memory, among other things. When you have less than 500 bytes, it's time to close that file and start another. This function also tells you whether Autolink is on or off, whether the "the" key is on or off, and whether the system is in math or print mode.
- Block operations allow you to mark a block of text and then manipulate it in several ways. You can copy the block in another area of the file, or even in another file; you can delete it; you can save it as a separate file; you can move it; or you can unmark it.
- Split screen. This function allows you to look at one part of a file while working on another. I find it useful for keeping format reminders and other notes on screen. When split screen is first selected, the top and bottom portions are of the same size. This can be adjusted to allow more or less lines in either portion.
- Automatic page numbering. Super-Text will place a page number wherever you want it on the page—chapter-relative, if you wish ("3-3" for the third page of chapter 3).

Super-Text II

Improvements made in Super-Text are indeed dramatic enough to justify the "II" tacked onto the name. In fact, they correct most of the minor complaints I had against the earlier version. New features are:

- Preview. This feature allows you to look at the text on screen, formatted according to your commands. With this feature you can see your formatting errors before you commit them to paper. The most important benefit is that you can see where the end of the page will be, and change that if need be, without a lot of hard-copy experimentation. Preview is accessed through the query function, with the "P" key toggling between preview and print.
- Temporary left margin. When printing numbered paragraphs, it's convenient for succeeding lines of

David C. Goodfellow, PO Box 66834, Seattle, WA 98146.

text to be indented the same as the first line. The earlier version of Super-Text tabbed over on the first line of such a paragraph, but succeeding lines began at the "true" margin, under the paragraph number. This feature is a welcome addition.

- Provision for shift-key capitalization. Muse gives instructions for a simple hardware change allowing use of the shift key for caps, and supports that change in the program. You must decide for yourself whether or not to implement it.

The change, though making typing easier, has two disadvantages. First, it voids the Apple warranty (as Muse warns).

More importantly, it curtails use of the "at" sign and the caret, which are alternate characters on the p and n keys, respectively. Since these are important to me, I will probably go back to using ESC for capitals. Note that the program does have some user-defined function keys that could be used to restore these characters, if you wish to use them for that instead of defining some exotic printer functions.

- Super-Text II has two additional modules available as separate purchases. The Form Letter Module ($100) and Address Book mailing list ($50) can be used in conjunction with Super-Text II to provide a powerful system for generating personalized form letters—a great tool for marketing by mail and sending out those Christmas letters. The Form Letter Module merges text from Super-Text II and names, addresses and comments from Address Book. An imaginative writer can make a form letter look as if it were written especially for the recipient.

Deficiencies

I do not like the fact that you can't copy the disk. With software pirates skulking about, the concept of protected disks is not likely to change. Although Super-Text II does have a copy feature, the copy is a slave which cannot be booted directly. To use it, you must first load the master disk. This is a pain at best. At worst, if you happen to roll your chair over the master disk, you're in a world of hurt.

Muse does include a spare master disk in its sales package and will replace a damaged disk for $10 and proof of purchase, but this does not provide the "safe" feeling of a half-dozen backup copies. To the casual user, this is probably not a problem; but I make my living with the Apple and word processing, and so get somewhat paranoid on the subject.

Super-Text II does not support an 80-column display as yet. Its new preview feature is a giant step toward showing you formatted text on screen, but it's not enough.

Super-Text II does not support proportional spacing. This is a surpise as well as a disappointment, for its instruction example for tailoring the program for the printer uses the Diablo, which has proportional spacing for those whose software supports it.

Conclusion

In general, I found Super-Text to be the answer to a free-lance writer's dream. It has greatly increased my production, and therefore increased my earning ability. Although easy enough for the occasional user, it is more than powerful enough to support the professional. Price is $150. ■

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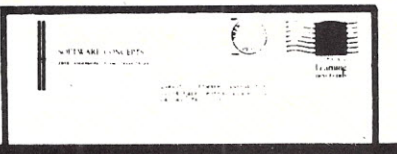
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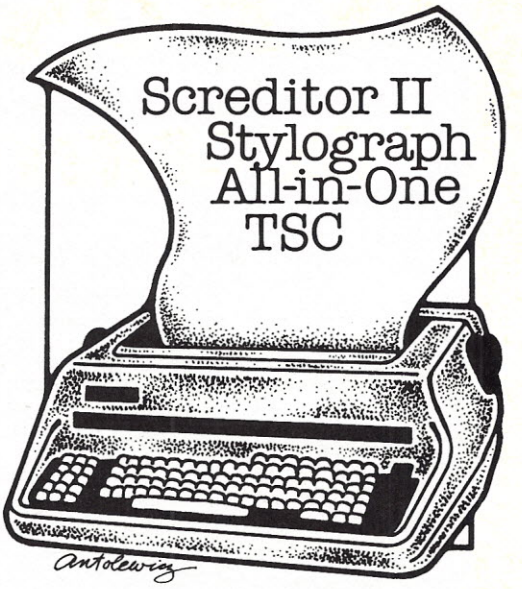
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Now discover what's available in text processing software for the 6800 and 6809.

6800's Best-Kept Secrets

By Peter A. Stark



Computer magazines have been full of stories on Electric Pencil, Wordstar, Scripsit and a variety of other text processing software for 8080 systems. As a result, few readers know that there are some mighty fine text editors and text processors for 68xx systems.

There are essentially four different packages from four different vendors:

The TSC Text Editor and Text Processor programs from Technical Systems Consultants (Box 2570, West Lafayette, IN 47906). The programs are available for both 6800 and 6809 systems, and the total price for both is about $100, depending on version.

The All-in-One editor/processor from AAA Chicago Computer Center (120 Chestnut Lane, Wheeling, IL 60090). Available in both 6800 and 6809 versions, it costs $35; source listing is also available.

The Screditor II editor/processor from Alford and Associates (PO Box 6743, Richmond, VA 23230). It is currently available only for 6800 systems, and costs about $80. Printed source listing or code on disk are available at extra charge.

The Stylograph editor/processor from Sonex Systems (Box 238, Williamsville, NY 14221). Currently only available for 6809 systems at $135–195, depending on version.

Of course, several other text editors are suitable for preparing either text or program material, but without text processing ability.

Address correspondence to Peter A. Stark, PO Box 209, Mt. Kisco, NY 10549.

Editors vs Processors

There is a fairly clear-cut difference between an editor and a text processor.

An editor is generally used to enter either text material or programs into the computer from a keyboard. The result is then a file on either tape or disk. To be most useful, an editor should allow the user to correct mistakes, move text around, copy selected lines to produce duplicate ones and, in general, edit the text. Once the file is prepared, the editor should let the user read it back into the computer, do some more editing and prepare a new file. In other words, an editor is primarily an input program.

A processor, on the other hand, is an output program. It takes a (supposedly error-free) file either from memory, tape or disk, and outputs it to the printer. While doing this, the processor may process the text in some way—separate it into lines of equal length, indent paragraphs, break up the text into pages, center headings, provide page headings and page numbers and so forth. In other words, the purpose of the processor is to take the text in the file and arrange it so that the printed output looks neat.

Thus, editors can be used to input text, programs or even data files to be used by other programs. Processors, on the other hand, work with text. For example, this article was first edited by a text editor, and then printed out by a processor.

The editor and the processor can be separate programs (as in the TSC package), or combined into one large program (as in the other three). Both approaches have good and bad points, as we shall see.

Text editors are generally either line- or character-oriented, though in some cases the distinction is somewhat blurred.

In general, a text editor holds much more text in memory than can be displayed on the terminal at any given time. If the text in memory is divided into lines (usually with lines separated by carriage return characters, hex 0D or octal 015), then the editor is line-oriented. If, on the other hand, the text is stored as one long string of characters without returns, then it is character-oriented. This is related to the way that text is entered from the keyboard—if the editor requires that a CR be typed at the end of each line, then it is line-oriented; if input can be typed in continuously without CR characters, then it is character-oriented.

A line-oriented editor generally edits one line at a time. Regardless of whether a CRT terminal or a hard-copy terminal is used, it usually (though not always) displays one line at a time, which is called the current line. Editing is done within that one line, and when a change is made, that line is displayed. Since only one line need be output at a time, such an editor is ideal for use with a hard-copy terminal such as a teletypewriter. For

that reason, all of the early editors were of this type. (There are, though, some line-oriented editors which use a fast CRT display, and often display the current line in the middle of the screen, with adjacent lines above and below.)

Character-oriented editors are somewhat different. They nearly always require a fast CRT display with an addressable cursor. Rather than having a current line, they have a current character, which is identified by the current cursor position. The cursor can be moved up and down or sideways by using the keyboard (or sometimes a joystick). Editing changes then occur at the cursor position.

The difference can most easily be seen when making changes. Suppose you want to change the word "necescary" to "necessary." With a character-oriented editor, the cursor is moved under the second c, and an s typed on the keyboard changes the current character to an s. The editor knows which character to change by the position of the cursor.

With a line-oriented editor, on the other hand, pointing to the line is not enough—it is also necessary to tell the editor which c to change to s since there are two c's in 'necescary' and there might be even more in the line. This is done either by counting, or by specifying the context.

Using counting, the command might be "change the second occurrence of c to an s." If you count wrong, the wrong c will be changed. With context, the command might be "change 'scary' to 'ssary.' " Enough of a string would be specified so that, hopefully, there would not be another similar one on the line to change. This often means that the user has to type in not only the new text, but also the old text so that the editor can figure out what to replace. This is quite time-consuming.

The difference between a line-oriented editor and a character-oriented editor can also be seen in how text is moved from one place to another. In a line-based editor, the editing command goes something like "take lines 135 through 145, and put them after line 10." In other words, entire lines must be moved. A character-based editor can move just sentences, words or even characters from one place to another. Though this is more versatile, the command to do the job is more complex since it is necessary to specify exactly what string is moved from where to where. For example, in Stylograph, the string being moved must first be enclosed by a double bracket. Then it is removed, and the cursor is positioned to its new location so the editor can place it there.

The TSC Text Editor

Historically, the TSC Text Editor was the first 6800 editor (actually, a small TSC editor preceded this one, but was never very popular). It is now also available for the 6809.

The original TSC version was for cassette systems, and required just slightly over 5K of RAM for the program; in a 32K system that left almost 27K of memory for text files (though, of course, few of us had that much RAM back then).

When disk systems became common, the cassette editor was adapted to run with them. Thus SWTP supplied the editor with the MiniFlex DOS and its five-inch disk systems; Smoke Signal offered it for their SSB disk systems; Percom offered a patch to make it work on their disk system as well. All of these editors were based on the original cassette version, with just some patches added to tie it into the disk system.

Eventually, TSC reassembled it to work with Flex 2.0, and once again to work with Flex 9 on the 6809.

In line with its origins back in the mechanical teleprinter days, the TSC editor is line oriented. It has a variety of commands which allow

- inserting or deleting lines
- moving and copying lines
- searching for specified strings
- replacing a specified string by another
- adding text to a line

It is an extremely versatile editor, but like other line-oriented editors is slightly awkward when editing on the character level. In some cases, adding additional functions to the TSC Editor is possible. For example, Percom's patch to the editor provides a new EDIT command which to some extent simplifies editing within a line. When CRT terminals are used, then the patch presented in next month's installment of this series can provide character-by-character editing like the more typical character-oriented editors.

The most important aspect of the TSC Editor lies in its use of tape or disk files.

The original cassette editor used tape files via a Kansas City interface on the control port. Although the tape format was fixed, and not compatible with that of any other software (including TSC's own processor), tape commands were quite versatile. The entire file could be written, or else just a part of the text could be output; new text being read in could be appended to that already in memory. Hence it was possible to combine files, or to break up long texts into several files in any sequence.

When the editor was adapted to MiniFlex and Flex, the situation was reversed. Disk format was now compatible with other software, so that the editor could prepare or edit assembly language or BASIC programs, and even data files used by BASIC. On the other hand, it could no longer be used to combine files.

When Flex and SSB DOS versions of the editor are called, input and/or output file names are specified, as part of the DOS command. If the file does not exist, a new file is created; if it does exist, then it is loaded and the old file is automatically made into a backup file. Hence backup files are created automatically to guard against data loss.

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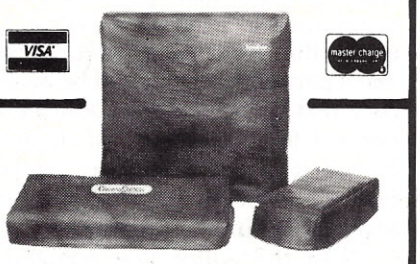
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This idiot-proof feature is designed to protect against mistakes, but it also creates some problems, since there must always be enough room for both the original file as well as the new file. This can be especially troublesome for single-drive disk users, for it limits file size to somewhat less than half a disk (since the editor must also be disk resident).

The Percom version (which is actually a patch to the cassette TSC Editor) is quite different. File names are specified as the editor is running, and are specified as disk sector addresses rather than file names. At any point it is possible just to read or write part of a file and then switch to a different file. For the more adventurous, it is possible even to overlay the new file over the old file. Thus it is possible to combine small files into a large file, or split a large file into several smaller files.

By changing disks between disk calls, a full-disk file can be read from one disk and written onto another disk, even in a single drive. The use of sector addresses rather than names makes the process a bit more dangerous if you don't keep careful records, but the versatility to my mind far outweighs the disadvantages. (This article, for example, is being prepared on a 6800 system with the Percom-modified editor on a Percom disk system. Before starting this last session, I loaded the text file beginning at sector 007 on a disk, and when finished, will put it right back in the same place on the disk.)

All of these editors allow editing of files larger than will fit into memory at one time. Flex editors read in as much of the file as will fit; when editing on this portion is done, a NEW command is given to write all or part of the memory-resident text back on the disk, and read in more text from the input file. The Percom version has a ROLL command which does the same thing, but also allows selective reading and writing of text.

There isn't much else to be said about the TSC Editor—it is very capable and well debugged. It works nicely and reliably, exactly as advertised.

The TSC Text Processor

This is a gem! Though it is the oldest of all, this processor is still probably the best. It will run circles around the competition, be it for the 6800, 8080, Z-80, or whatever.

Basically, the text processor processes files prepared by a text editor; it has no editing capability of its own. The cassette version has a major problem. Though nominally a cassette version, it only comes on cassette—it has no cassette read commands as such. It assumes that the text is already somehow in memory, and has no way to read the nonstandard cassette format used by the text editor. A long time ago I came up with a solution, and will include it in a future installment if there is any interest.

The disk versions simply read the text from the disk, one sector at a time, and process it. Since most disk motors stay on for quite a while after an access, this means that the motor may run continuously for as long as it takes to print the file, a minor inconvenience.

Processor commands are inserted into the text during editing—any line beginning with a period in column 1 is assumed to be a processor command. Easily remembered mnemonics are used. For example, the text

```
.SP 3
.CE 1
Processor Commands
.SP 1
  This is a sample of a short text which is going to be processed by the processor.
```

tells the processor to space three lines, center the following one line, space one line, and continue with the text.

Frequently-used series of commands can be defined at the beginning as a macro, and then called just by the macro name. Moreover, on Flex disk systems, the macros can be put into a separate macro file on the disk, and automatically read by the processor before processing. Thus, they need not be separately included in every text file being processed.

Of more interest is what the processor can do to text. Here is a short list:

Text can be left or right justified, centered on a line, or left with a ragged right margin. When unjustified, it can be repeated exactly as typed in the source file, or else lines can be stretched or compressed to be all approximately the same length. When justified, lines are stretched so they are all the same length. This is done by inserting extra spaces between words, with alternate lines being stretched on the left and right so that the extra spacing is not as obvious.

Lines can be indented.

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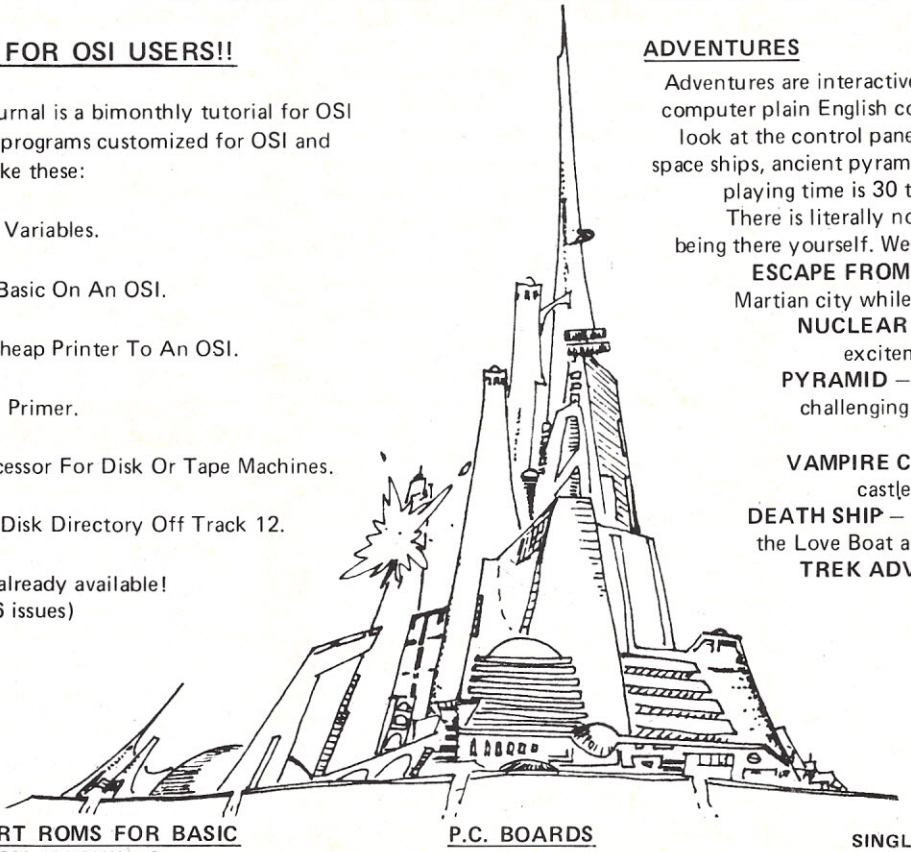
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can be centered, flush left, or flush right, as well as page numbers in either Arabic or Roman numerals. Page numbers are automatically kept track of by the processor. If desired, headings and footings can be different on even and odd pages; for example, the page number could be on the lower left corner of even pages, and the lower right corner of odd pages; for a text to be printed on both sides of the paper, this would place the page numbers on the lower outside corners.

In addition to the automatic page numbering, the processor maintains a number of internal registers which can be manipulated by the text and included in the processed output. For example, it can automatically insert dates as required, or keep track of figure or table numbers.

But there are various other features as well. Suppose that the text is to include a table which must be together all on one page. The .NL command can specify that a certain number of lines is needed at any point; if the processor does not have that many lines available on the page, it will space to the next page and continue there. This will guarantee that enough room exists for the figure or table.

The processor also handles footnotes. In the source text, the footnote is included directly after the word it applies to. When the processor is outputting text, it will place the footnote at the bottom of the page. If there is not enough room, it will be continued at the bottom of the next page.

The processor can print out in a continuous stream for printers using roll or fan-fold paper, or can pause at the end of each page to permit a new sheet of paper to be inserted. It can drive the standard terminal, or an optional printer driver can be included for output on a separate printer.

When a printer is used, the processor can print messages on the terminal and accept additional text from there to include in the text stream. Thus, it could be used to customize form letters.

There is more than can be reasonably written up here. There are some disadvantages, of course. There is so much to the processor that very few users would ever learn all of it. I have developed a usable subset of its commands that I commonly use, and the rest just lies forgotten. I shudder at the thought of a secretary trying to learn it all. Fortunately, both editor and processor commands use mnemonics for the corresponding operations, which makes them easier to remember.

Unfortunately, current versions of the processor do not support the new daisywheel printers that offer proportional spacing, underlining, subscripts and superscripts. But TSC is rumored to be working on a newer version which would work with them.

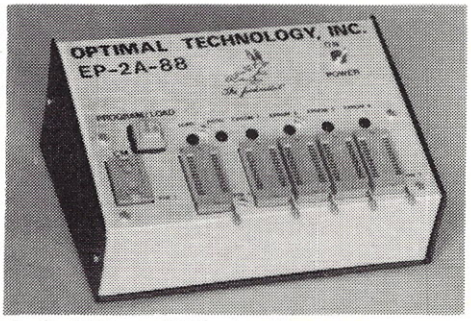
The All-in-One Editor/Processor

Of all the 68xx editors and processors, the All-in-One at $35 must be the cheapest. I have not actually had the chance to try it out, so my comments will be based on documentation and discussions with its vendor.

This editor/processor contains both editing and processing functions in one program. It is line-oriented, and can be used on ordinary CRT termi-

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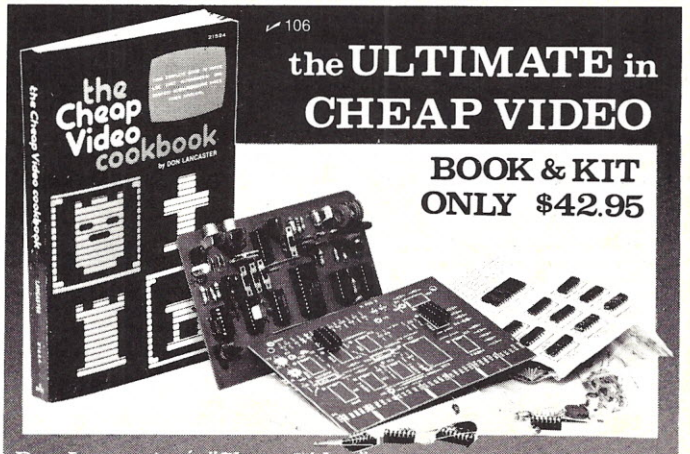
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nals as well as hard-copy terminals.

Its editing is straightforward, and text can be inserted, deleted or changed. It can be moved from place to place, or copied. Lines can be centered or justified, and output can be separated into pages and pages numbered.

Output can be to the standard port 1 terminal, or to a separate printer. The editor/processor can issue special printer control characters to printers to produce special functions such as bold print or underlining. Either serial or parallel interfaces can be used.

The All-in-One editor processor has versatile file-handling capabilities. It can merge smaller files together, or separate a long file into several smaller files. It can also edit very long files by bringing them into memory a piece at a time, as much as fits into available memory. (It is available in 6800 or 6809 Flex or SSB DOS versions).

This particular editor/processor is unique among the 68xx programs in that it easily handles mailing lists and label printing. It is possible to bring in a main text file, and intermix it with text from a second disk file. For example, the text for a letter can be in the main file, while a second disk file can have a list of names and addresses. The editor/processor will then read the name/address file and insert it into the body of the letter. Thus, it can print customized form letters which can also contain customized salutations and even customized text.

If the main file is empty, then just the names and addresses can be printed. This is useful for printing labels only. Labels can be printed one across a line, or several across. Interestingly enough, the same function that allows for printing two or more labels across a line can also be used to print text in two columns across a page. That is a fairly unique capability among processors.

The Screditor II Editor/Processor

As the name implies, the Screditor II is a screen editor. It is available for video-board-based systems, and does its editing directly on the screen. It is available for several 6800 disk operating systems, including Flex and SSB DOS, as well as several different video boards, including the F&D, Gimix, Percom and Thomas boards. (It is not currently available for 6809 systems, but may well appear in that form later.)

In a strict sense, Screditor II is an editor, not a processor. But it is included here because it does have some processor commands, and can therefore be used for limited processing as well as editing.

Screditor II is character-oriented. The keyboard controls the cursor, which can be moved anywhere on the screen. In addition, the text can be scrolled up or down on the screen as well. Once the cursor is properly positioned, the editor can insert, delete or change text. As this is done, the revised text appears directly on the screen.

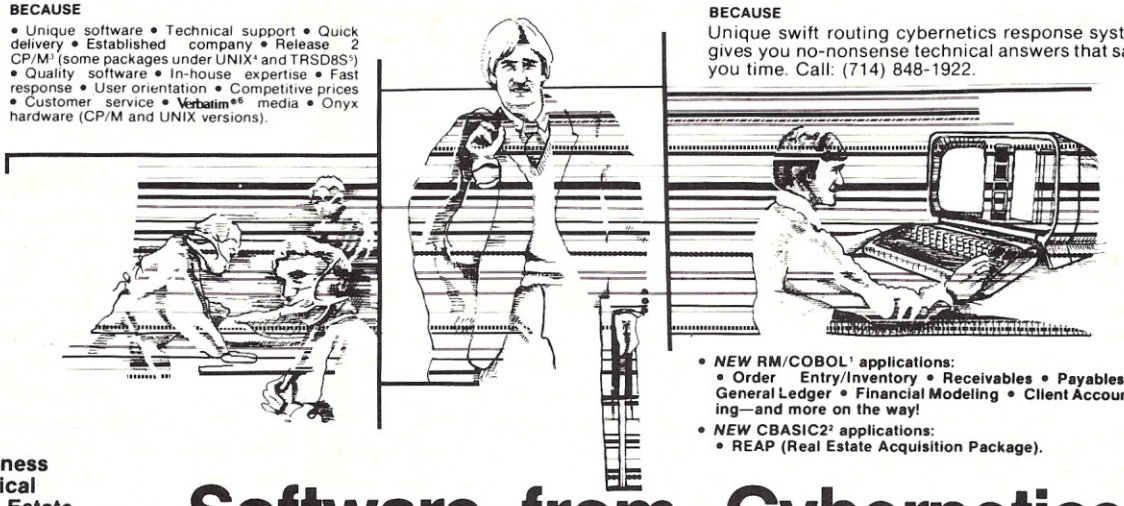
The editor has two operating modes—line and text. In line mode, entry of each line is ended by a carriage return, and the cursor stops at the end of the line when it runs out of room. This mode is used for entering programs.

In text mode, text is entered with-

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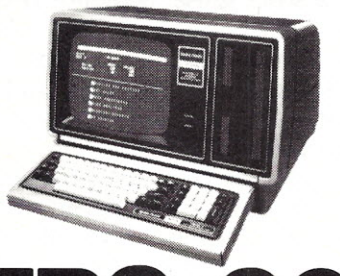
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out typing carriage returns. When the cursor reaches the right margin (whose location is specified by the user), it automatically goes to the next line. Moreover, the word being typed at that point is moved to the next line as well, so that words are not split up across line boundaries. In this way it is not necessary to watch the screen and hit the return at the end of each line, as is necessary with the TSC text editor to avoid running off the end of the line.

Since moving words around the screen and memory takes time, Screditor II (like most screen editors) can accept keyboard input via interrupts. In this way keyboard characters being typed while the editor is busy rearranging characters in memory or on the screen aren't lost—they are put into a queue and processed in turn as soon as the editor gets to them, seldom more than a fraction of a second later.

To simplify text entry even more, it is possible to pre-define words, phrases, or commands as macros, and then refer to them by a single character. (This would have been especially useful in preparing this article, since phrases like 'Screditor II' wouldn't have to be typed over and over.) Tabs can be set to ease text or program entry.

Once the text has been entered, it can be manipulated. Left and right margins can be redefined, and text rearranged to fit them. Lines can be centered, made flush right, shortened or lengthened. All this happens on the screen, and it would be interesting to watch words move around—if it didn't happen so fast. It is also possible to justify lines, although the command sequence is a bit awkward —after all, this is an editor, not a full processor.

File manipulation is extremely versatile. It is possible to edit extremely large text, larger than available memory, since Screditor II will read large files into memory in segments. It is also possible to merge disk files, or to split a large file into smaller ones. One interesting application is to put individual phrases or sentences on the disk as separate files, and then write form letters by picking the appropriate ones as needed.

When editing an old file from disk, Screditor II automatically assigns sequential extensions (such as .X01, .X02, etc.) to succeeding generations of text so that it is easy to keep track of which came last.

Screditor II has facilities for printer routines; this, combined with its on-screen editing, makes it possible to format a text on the screen exactly as desired, and then print a final document.

As compared with the TSC editor/processor combination, Screditor II does have disadvantages—its processing is limited, for example, and there are no provisions for page numbering or page titles. There are many possible editing commands, and many of them are very hard to remember. For example, control-E means insert, control-I means tab, control-T means lowercase, control-L means go down and so on. (Part of the problem, of course, is that there are quite a few commands in a combination editor and processor, and not all of them can be identified by unique mnemonics. Stylograph, for example, has exactly the same problem.)

Moving text around is also somewhat awkward. Essentially, to move a block of text from one place to another, Screditor II writes it out to disk as a temporary work file, and then reads it back into its new place. This is not nearly as fast or convenient as the MOVE or COPY commands of TSC's editor.

On the other hand, the ability to see on the screen exactly what the final document will look like is very useful.

Customization to various systems is especially well-handled. To make adaptation easier, Alford and Associates supply a second program called SYSGEN in the package. SYSGEN should be run first, even before trying Screditor II.

SYSGEN asks questions about the system configuration—such as what kind of video board is used, what kind of keyboard, system addresses for the video memory and keyboard, margin and page size and so on. Then it generates assembly language source code for a patch which must be assembled and overlaid over Screditor to adapt it to the specific system configuration.

This is an exceptionally good arrangement, since the resulting code prepared by SYSGEN is itself very well commented. Thus, even if SYSGEN doesn't quite cover the exact system configuration, it is a simple matter to edit the resulting source file before assembly. Moreover, the source program, along with the information in the manual, makes it easy to reconfigure Screditor II if the sys-

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tem is changed in the future. (The manual does not contain a complete source listing for Screditor II, but it is available separately at extra cost. I originally thought I would need it to try out the editor on my very nonstandard system, but it turned out that the normal documentation along with SYSGEN was quite sufficient.)

Stylograph Editor/Processor

The newest of the four editor/processors described here is Stylograph. It combines a full-fledged, screen-oriented, character-oriented text editor with a text processor.

Stylograph is available only in a 6809 version to run either under Flex or under Microware's OS-9 (it is the only OS-9 editor/processor currently available). It requires either a Gimix 24×80 video board, or a CRT terminal running preferably at 9600 baud, and supports either a plain TTY-style printer, or one of the daisywheel printers (but not the older Diablo Hytype I). When using daisywheel printers, Stylograph can provide underlining, bold face and even subscripts and superscripts. In some cases, the print driver may also do forward-backward printing. Unfortunately, as Sonex does not supply any program listings or customization information, it must be ordered for the specific hardware configuration to be used.

As with Screditor II, editing is done by moving the cursor to the location to be edited, and then typing away. As a change is made, Stylograph immediately makes the change on the screen. If necessary, a word extending past the end of the line is moved to the next line, and the rest of the paragraph is rearranged. Since this may take some time, Stylograph also uses interrupt-driven keyboard input, so that characters typed in while Stylograph is busy are saved in a queue and processed when ready.

Text processing commands similar to those used by the TSC processor can be embedded in the text to justify text, center lines, skip spaces, provide for page headings or footings, number pages and so on. (In fact, there is a striking similarity between TSC commands and Stylograph commands—for example, the TSC command to center one line is .CE 1 whereas the command is ,ce 1 in Stylograph.) Most of the TSC processor functions are implemented here, though some are not—for example, Stylograph cannot automatically number figures, insert dates, or properly position footnotes.

Take as an example this article. In manuscript form it takes up just under 33K characters. In a standard 6800 system having 32K of continuous memory from $0000 through $7FFF (and assuming that the DOS is located elsewhere), subtracting about 7K for an editor such as TSC's leaves about 25K of memory. Thus this article does not fit, and must be edited in two pieces.

The TSC editor, as well as Screditor II, can edit it as one big file, however, although it does so only one part at a time. The TSC processor can process the entire file in one piece, since it only reads in part of the file at a time. (My own nonstandard system, which has I/O moved to address $F800, has 40K of continuous memory, and thus I can edit and process the entire 33K article in one piece.) Thus it is quite feasible to edit and process this article on the 6800. (The same is true of a 6809 with the TSC editor and proces-

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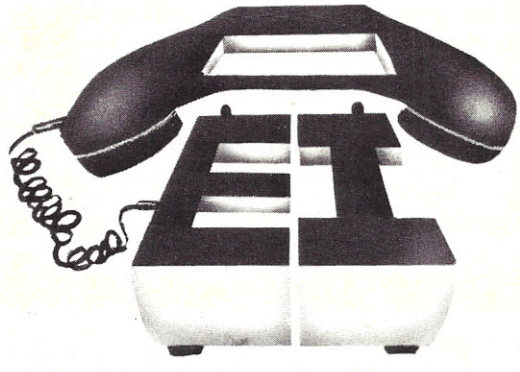
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sor.)

But take the same 48K system with a 6809 and Stylograph. Subtract 8K for a DOS and about 17K for Stylograph, and less than 23K is left for text. Since the text cannot be segmented, this article cannot be edited or processed. Even a 56K system, as large as one can get without going into memory mapping and extended addressing, is just a bit too small.

On the other hand, Stylograph does offer a few functions which the other editors do not. For instance, a "ghost hyphen" can be inserted into a long word. If the word appears in the middle of a line, then the hyphen disappears. But if the word appears at the end of a line, then the hyphen may be used to split up the word if necessary. All of this is, of course, automatic.

The major difference is that the TSC editor/processor is a two-step process. You insert the processing commands into the text with the editor, and then execute the processor to see whether they worked. Since it is easy to forget a command or use the wrong one, it is often necessary to go back between the editor and processor several times before the output text looks just right. In Stylograph (and Screditor II as well) the effect of processing commands appears directly on the screen, so you immediately see the text as it will appear in the final printout.

Stylograph is capable of merging smaller files into one file memory, or writing out parts of the text in memory to different output files. But it has one serious limitation—if a text file is too big to fit into memory at one time, it cannot segment it and process one part at a time. Thus the maximum file size is limited by memory size. The situation is compounded by the fact that Stylograph is big (since it combines both an editor and a processor in one, it takes about 17K of memory).

Although a long text could be split into two smaller files, this creates problems for a text processor since the first file might end in the middle of a page, and there is no way to continue printing the second file so that it exactly continues in the same place where the first file left off.

A second disadvantage of Stylograph is the fact that a specific version must be purchased for each hardware configuration. While it is unlikely that a user would change the entire system, it is quite possible that he might change to a different video board or different terminal. In that case, he would have to get a new version of Stylograph, since its output drivers are specifically tailored to the display hardware.

Stylograph can be used with either a video board or terminal versatile enough to move the cursor around and clear the screen. On a screen-oriented editor, being able to locate the cursor quickly is a definite asset, and both Stylograph as well as Screditor II make it easier by flashing the cursor at certain times.

There is an interesting contrast here between Stylograph and Screditor II. Stylograph is only available for one video board (the Gimix 24×80 board), and Sonex prefers to use sophisticated terminals (such as Hazeltine, Heath, and others) which provide cursor control and screen scrolling on command. Screditor II, on the other hand, supports a variety of video boards but not sophisticated terminals.

In those cases where an intelligent terminal is used, the two programs can run roughly at equivalent speeds. But when a dumb terminal is used, or where the terminal simply does not support hardware scrolling so that an entire screen must be rewritten to scroll up or down one line, then Stylograph is hampered by the baud rate limitations of the serial line to the terminal.

Which Is Best?

There is really no definite answer to this question, as each editor/processor does things the others can't. To a large extent it depends on the hardware you have available, and the use to which you will put the system. I suppose it breaks down like this:

For 6800 cassette systems: no choice. Only TSC supports cassette.

For Percom disk systems: TSC (Screditor II or All-in-One if running Flex or SSB DOS).

For extensive and complicated processing: TSC.

For labels and form letters: All-in-One.

For video-board systems not using Gimix board: Screditor II.

For SSB disk systems: Screditor II, All-in-One, or TSC (from SSB).

For OS-9: Stylograph.

For intelligent video terminals: Stylograph.

For very long files: TSC, All-in-One, or Screditor II.

For 6809 cassette systems—sorry, no choice. None of them will do.■

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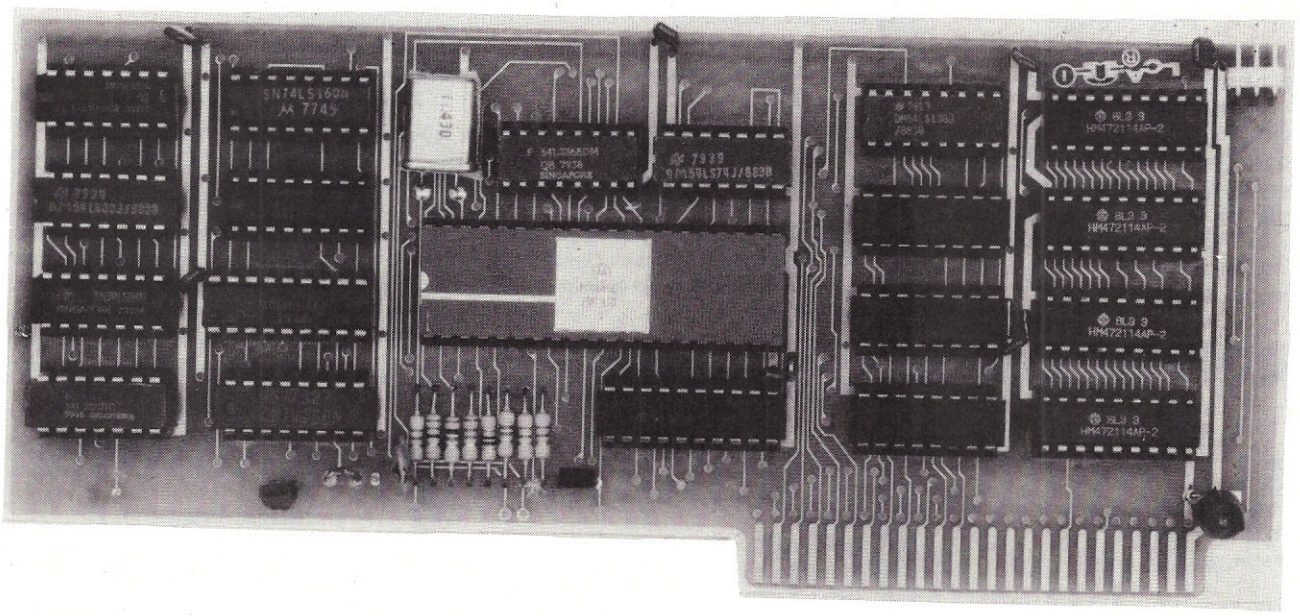


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Bare Bones Word Processor-Text Editor

Computer model: OSI with 8K
Printer model: OSI-compatible
Mass storage: Cassette
Price: $9.95
Vendor: Elcomp Publishing, Inc., 3873L Schaefer Ave., Chino, CA 91710
Highlights: Minimal system with up to 80 lines of text that can be formatted at a time. Can add, insert, change and delete. Has a warning arrow for right margin.

CAPDOC

Computer model: 8080, 8085 or Z-80 with 48K minimum
Operating system requirements: CP/M or MP/M with CBASIC
Mass storage: Disk
Price: $295 for CP/M version, $345 for MP/M version
Vendor: Monoson Microsystems, Inc., 51 Main Street, Watertown, MA 02172
Highlights: Company individually configures each system to the user's hardware. Includes screen editing, word processing, data forms creation, data entry and data file capture. Allows block move, block copy, merging and high speed search. Has full screen editor with forward and backward scrolling. Allows variable paragraph indenting, variable line spacing, automatic headers and footings (including odd-even) and automatic page numbering. Literal mode allows graphics characters.

Electric Pencil 3.0

Computer model: TRS-80 Model II
Printer model: All serial, parallel printers
Operating system requirements: TRS-DOS 2.0 or CP/M
Mass storage: Disk
Price: $325 ($149, Model I)
Vendor: IJG Computer Services, 1260 West Foot Hill Blvd., Upland, CA 91786
Highlights: User-selectable multiple print drivers, dynamic print formatting, multi-column printing, page-at-a-time scrolling, bidirectional multi-speed scrolling, subsystem with print value scoreboard, automatic word and record number tally, global search/replace, full margin control, end-of-page control, nonprinting text comments, line and paragraph indentation, centering, underlining, boldface, proportional spacing with justification.

Star★Typist

Computer model: 8080, Z-80 with North Star (or equivalent) disk hardware
Mass storage: Diskette
Price: $500
Vendor: Micro Complex, 25651 Minos St., Mission Viejo, CA 92691
Highlights: For memory-mapped video board. Uses full screen display. Text can be typed continuously. Horizontal tabbing. Discretionary hyphenation. Dynamic print parameters. Complete set of utilities. Merge disk program.

Screditor II

Computer model: 6809
Printer model: NEC, Diablo, Qume, TTY-type
Operating system requirements: Flex
Mass storage: Disk
Price: $150, $135 (TTY-type)
Vendor: Sonex Systems, Box 238, Williamsville, NY 14221
Highlights: Screen oriented, cursor controlled, boldfacing, subscripting, underlining, no specialty keys required.

Memorite III

Computer model: Vector Graphic
Printer model: NEC, Diablo, Qume
Mass storage: Disk (5-1/4- and 8-inch floppy and hard disk)
Price: $450
Vendor: Vector Graphics, 31364 Via Colinas, Westlake Village, CA 91361
Highlights: Built-in quick reference manual, built-in 17-page memory capacity, user-programmable software, spelling correction, merge capability, program protection, document directory alphabetized, full proportional spacing, footnotes.

Super Editor

Computer model: Versions for TRS-80 III, 1802s
Printer model: Most
Mass storage: Cassette
Price: TRS-80, $100; 1802, $50
Vendor: Donald R. Shroyer, 209 Brinker St., Latrobe, PA 15650
Highlights: Line-oriented program permits user to create, edit, format, store, retrieve, print out text of any kind. Commands operate on lines of text chosen by user.

Word Processing Program

Computer model: PET
Printer model: NEC Spinwriter or PET-compatible
Mass storage: Cassette
Price: $29.50 (8K), $39.50 (16/32K)
Vendor: Connecticut Microcomputer, Inc., 34 Del Mar Drive, Brookfield, CT 06804
Highlights: Incorporates print directives, including line length, line spacing, left margin, centering and skip. Edit commands allow you to insert lines, delete lines, move lines and paragraphs, change strings, save files onto cassettes, load files from cassette, move up, move down, print and type.

Magic Wand (1.1)

Computer model: Any CP/M- or OASIS-based unit
Printer model: Any character printer, or dot-matrix printer with special mode
Operating system requirements: CP/M or OASIS
Mass storage: Disk
Price: $395
Vendor: Small Business Applications, 3220 Louisiana St., Houston, TX 77006
Highlights: Proportional spacing, easy to use, good documentation, underlining, boldface, subscripts, superscripts, overprinting (up to nine offset images), unique "cut and paste" insertion ability. Built-in micro language similar to BASIC that allows you to handle form letters, boilerplating and contracts. Ability to take data out of one file or multiple files and insert into letter text.

Text Editor/Text Processor

Computer model: 6800, 6809, 8080 (Z-80)
Printer model: CP/M- or Flex-compatible
Operating system requirements: 6800 Flex, 6809 Flex, Uniflex, CP/M (8080)
Mass storage: Cassette (6800) and disk
Price: $50 (Text Editor), $75 (Text Processor), $100 for Uniflex Text Processor (Text Editor included).
Vendor: Technical Systems Consultants, Box 2570, West Lafayette, IN 47906
Highlights: User-defined printer output; over 50 commands for multiple spacing, indenting, saving contiguous text, right/left justification, centering, page numbering, titling; ability to define macros for special effects.

Super Text II

Computer model: Apple II, Apple II Plus, 48K, single disk drive
Printer model: Apple-compatible
Operating system requirements: DOS 3.2 or 3.3
Mass storage: Disk
Price: $150
Vendor: Muse Software, 330 N. Charles St., Baltimore, MD 21201
Highlights: Optional software (Form Letter Module, $100, and Address Book, $50) lets you automatically print personalized letters and create a mailing list of letter recipients. Preview mode to view a file as it prints, shiftkey compatibility, menu option to directly transfer printer driver from disk, math capabilities. You can create your own user prompts.

SUBSCRIPT/SUBEDIT

Computer model: TRS-80 Model I or III with 32 or 48K
Printer model: Radio Shack Line Printer, Centronics 737 (all six fonts), Epson MX-80, Diablo 1620 and standard serial printers/terminals through user's interfaces.
Operating system requirements: TRSDOS 2.3, NEWDOS 2.1 or NEWDOS/80
Mass storage: One disk drive for Model I, two drives for Model III
Price: $79.95
Vendor: ProSoft, Box 839, North Hollywood, CA 91603
Highlights: Allows autosave after every N lines, page or line scrolling and searching for a string over any range of lines and/or columns. It can move or copy text blocks within a file, has chained, or appended, files, automatic page numbering, automatic headers and footings and allows multiple fonts, proportional spacing and right/left-justified or centered format.

Maxi-Pros

Computer model: All OSI disk systems
Printers: OSI-compatible
Operating system requirements: Compatible with all OSI disk-operating systems
Mass storage: Disk
Price: $39.95
Vendor: Aardvark Technical Services, 1690 Bolton, Walled Lake, MI 48088
Highlights: User can make changes to the BASIC program to customize his system: for example, changing a few lines results in a blinking color cursor for users with color video. Line-oriented system makes it easy to use. Allows text editing, left/right justification, automatic page numbering, adjustable vertical spacing and chaining data. Can be made to stop during printing for the operator to add text. The format can be changed with embedded code or by direct command.

Stylograph

Computer model: 6809
Printer model: NEC, Diablo, Qume, TTY-type
Operating system requirements: OS-9 or FLEX
Mass storage: Disk
Price: $150 for NEC, Diablo or Qume printers; $135 for TTY-type. Versions available for a variety of terminals.
Vendor: Sonex Systems, Box 238, Williamsville, NY 50304 (for FLEX version); Microware, Box 4865, Des Moines, IA 50304 (for OS-9 version)
Highlights: Cursor oriented with text on the screen formatted the way it will appear when printed. Display is continually updated. Allows scrolling and block move, copy or delete. Automatic headers and footings per operator instructions. Discretionary hyphens can be added to allow hyphenation if word falls at the end of the line. Allows text to be centered or justified. Offers a variety of special printing options dependent upon the printer used.

WP6502 Versions 1.2, 1.3

Computer model: Ohio Scientific
Printer model: All ASCII RS-232, Centronics Parallel, NEC Parallel (5500 and 5530), NEC Serial (5510 and 5515) and the Qume, Xerox and Diablo equivalents to NEC
Operating system requirements: OSI OS65D and OS56U
Mass storage: Diskette, cassette (1.2 only)
Price: $100 diskette, $250 (1.3), $50 cassette (1.2).
Vendor: Dwo Quong Fok Lok Sow, 23 East 20th St., New York, NY 10003
Highlights: Automatic pagination, true proportional spacing and justification, online entry, merging with other files, page headers and numbers, underlining, boldface, superbold, centering, discretionary control characters. User may set up files of up to 100 text blocks. Version 1.3 allows you to view a screen full of text, edit that screen and then view the revised text.

Tex 2.0

Computer model: Z-80, 8080, 8085 systems
Operating system requirements: CP/M
Mass storage: Diskette
Price: $100
Vendor: Digital Research, PO Box 579, 801 Lighthouse Ave., Pacific Grove, CA 93950
Highlights: Generate an index and table of contents, produce superscripts and subscripts, accept insertions from the user console of a second source file and chain source files. Also offers proportional spacing, shadow print, bold overprint and auto-underline for Diablo 1640/1650 printers.

Docuwriter Text Processor

Computer model: Apple II, Apple II Plus
Printer model: Letter-quality printer
Mass storage: Disk
Price: $149.95
Vendor: Charles Mann & Associates, 7594 San Remo Trail, Yucca Valley, CA 92284
Highlights: Allows you to link documents too long for system memory and link mailing list and letter files into form letters. Global search/replace, width reformatting, line editing, character insertion/deletion, line insertion/deletion, block movement, subscripts, superscripts, footnotes, scientific notation.

Vedit

Computer model: North Star, Heath H8 & H89, Superbrain, Cromemco, TRS-80 I & II, Sorcerer, S-100
Operating system requirements: CP/M
Mass storage: Diskette
Price: $110, $100 for TRS-80
Vendor: CompuView Products, Inc., 618 Louise, Ann Arbor, MI 48103
Highlights: Full screen editor, full array of cursor movements, screen scrolls forward or backward automatically, function keys for character delete, line delete and allowing line splitting and concatenating.

VTS/80

Computer model: 8080, 8085, Z-80
Operating system requirements: CP/M
Mass storage: Diskette
Price: $549
Vendor: National Microsoftware Producers, Inc., 3169 Fillmore St., San Francisco, CA 94123
Highlights: Designed for secretaries or temporary personnel with no experience with word processing. Includes replacement set of keytops for CRT. Keytops operate with over 90 percent of commercially available CRTs. Dutch, French, German, Spanish versions available.

Secretary

Computer model: North Star or CP/M
Operating system requirements: CP/M
Mass storage: Disk
Price: $99
Vendor: G. Young, Inc., PO Box 3218, North Hollywood, CA 91609
Highlights: You can customize the program to your system. Carriage returns unnecessary, as lines wrap around. Files can be chained for large documents. Program is line-number-oriented for ease in locating lines and manipulating data. Will line-fill, justify, center and tab. Allows titles, page numbering, multiple copies and multiple printers.

Wordcraft-80

Computer model: CBM with 32K
Printer model: NEC, Diablo, Qume, Starwriter, Centronics, Commodore
Mass storage: Disk
Price: $395
Vendor: Commodore/MOS Technology, 950 Rittenhouse Road, Norristown, PA 19401
Highlights: Video screen shows how text will look when printed. For large page formats the screen scrolls vertically and laterally. Allows chaining of data for large documents, and packs the stored text so memory is used efficiently. Lines wrap around so the return key is only used at the end of a paragraph.

Sword

Computer model: Exidy Sorcerer
Printer model: Paper Tiger 460
Mass storage: Cassette
Price: $34.95
Vendor: Northamerican Software, PO Box 1173, Station B, Downsview, Ontario, Canada M3H 5V6
Highlights: Full cursor editing, scrolling, character insert and delete, right justification, text centering, margin indent, auto page numbering, move display window 20 lines forward, transfer blocks of text, preview text before printing.

WORD IV

Computer model: TRS-80
Operating system requirements: TRS-DOS
Mass storage: Diskette
Price: $49
Vendor: Micro Architect, 96 Dothan St., Arlington, MA 02174
Highlights: Automatic line filling, vertical spacing control, right margin justification, title and page numbering, centering control, upper-lowercase capability without keyboard modification.

Magic Window

Computer model: Apple
Printer model: Any printer
Operating system requirements: DOS 3.2 or 3.3
Mass storage: Disk
Price: $99.95
Vendor: Artsci, Inc., 10432 Burbank Blvd., North Hollywood, CA 91601
Highlights: Operator-oriented, draws a page on screen to view placement of text as you type it, line counter, page counter, column counter, proportional spacing eliminates need for hyphenation, master menu displayed on screen, file storage. Accommodates any features added to the Apple.

Letter Writer

Computer model: TRS-80 I, III
Printer model: TRS-80-compatible
Mass storage: Cassette, disk
Price: $23.96 (tape), $37.97 (disk)
Vendor: Astro-Star Enterprises, 5905 Stone Hill Drive, Rocklin, CA 95677
Highlights: Full cursor control; insert, change, move and delete characters, words and lines; line per page count; line centering.

WordPro 4-Plus

Computer model: Commodore CBM 8032
Printer model: Any ASCII printer
Mass storage: Diskette
Price: $450
Vendor: Professional Software, Inc., 166 Crescent Road, Needham, MA 02194
Highlights: Math functions, superscripts, subscripts, bold overstrike, exit to BASIC, variable lines per inch, additional pitch settings, audible feedback, pause command and simultaneous input/output. Begin printing from any page.

Lettergo

Computer model: North Star
Printer model: Diablo 16XX, NEC 55XX, TTY
Operating system requirements: North Star DOS
Mass storage: Disk
Price: $495
Vendor: Datek Systems, Inc., 4786 Lee Highway, Arlington, VA 22207
Highlights: Full-screen editing, bidirectional scrolling, global search/replace, automatic end of page, auto-centering, page numbering, titles/footers, justification, superscript, subscript on letter-quality printers. Available in French, German, Spanish, Scandinavian.

Write-On I, Write-On II

Computer model: Apple II, Apple II Plus
Printer model: Apple II-compatible
Operating system requirements: DOS 3.2 (3.3 compatible)
Mass storage: Disk
Price: $99.50 (I), $150 (II)
Vendor: Rainbow Computing, 9719 Reseda Blvd., Northridge, CA 91324
Highlights: Move, copy, delete and insert large blocks of text lines with a single command; edit and merge any text disk file and spool text to disk for later printing or editing; margins; tabs; titling; indenting. With the Data File Writer for the Write-on II, you can write a personalized form letter or mailing label for persons on a mailing list.

PIE (editor), FORMAT

Computer model: Apple II, Apple II Plus
Printer model: Can be configured for virtually any printer
Operating system requirements: DOS 3.2 (3.3 compatible)
Mass storage: Disk
Price: $129.95 (40- or 80-column versions)
Vendor: Programma International, 2908 North Naomi St., Burbank, CA 91504.
Highlights: Move blocks of text, global search/replace, handle form letters, 99 copies of same document, GET line feature, centering, underlining, vertical spacing, add titles, indenting, word/line count.

HESEDIT

Computer model: PET
Mass storage: Cassette, diskette
Price: $12.95 cassette, $15.95 diskette
Vendor: Human Engineered Software, 3748 Inglewood Blvd., Room 11, Los Angeles, CA 90066
Highlights: Repeating keys, scrolling commands to page forward and backward by any amount, merging of many files into one, tab keys. Special "window" feature presents 22 lines of data to be manipulated at a time. You can insert, delete, duplicate and change as many of these lines as you wish.

WordStar

Computer model: CP/M and derivative models
Printer model: Daisywheel and TTY-type printers
Operating system requirements: CP/M
Mass storage: Disk
Price: $495
Vendor: Micro Pro International, 1299 Fourth St., San Rafael, CA 94901
Highlights: Mailmerge option to insert data from a file anywhere into the letter text, prepare form letters and print multiple copies. Hyphenation help, print spooling, help messages, word wrap, decimal tab.

WP-730.4

Computer model: TRS-80
Printer model: Line Printer II, Centronics 730 series, other TRS-80-compatible computers
Mass storage: Cassette
Price: $35
Vendor: GB Associates, PO Box 3322, Granada Hills, CA 91344
Highlights: No limit to typing speed. Upper/lowercase printout. Change line length from one to 80 characters. Adjustable margins, right-justify, expanded printout, centered lines, indented lines.

Word/Magic II

Computer model: TRS-80 Model II with 64K

Printer model: Preferably those with parallel interfaces

Operating system requirements: TRS-DOS 1.2 (preferably)

Mass storage: Disk

Price: $195

Vendor: Data Strategies, Inc. (formerly CalData Systems), PO Box 28726, San Diego, CA 92128

Highlights: BASIC program can be modified by the user. Can produce personalized form letters by merging the text file with a mailing list file. Has table of contents generator, and allows automatic headers and footers (three line), automatic page numbering, justification and wrap around lines. It has a full screen editor. Special printing functions such as subscripts and superscripts are available depending upon the capabilities of the printer.

The preceding word processing software directory makes no claim to be a comprehensive list of all available programs. It represents a sampling of software for selected systems.

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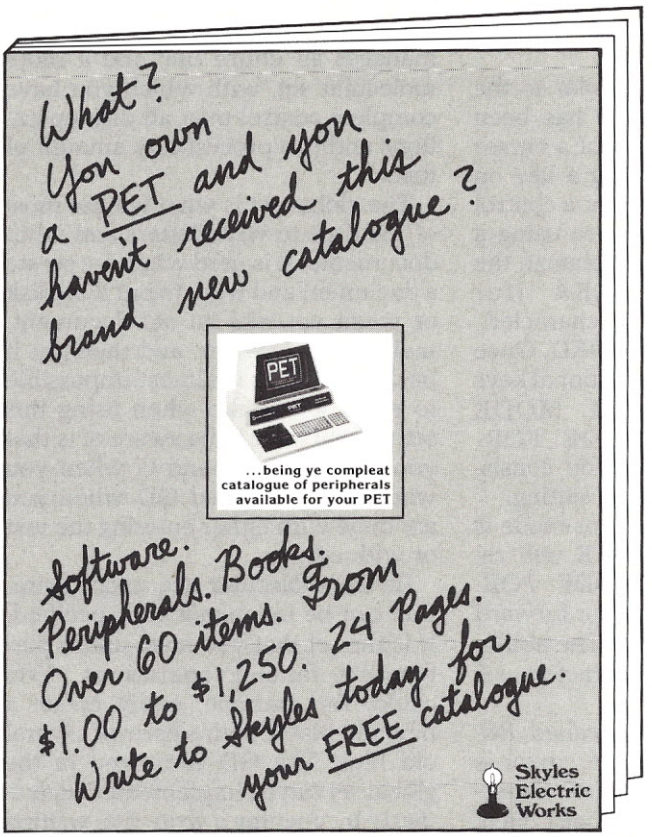
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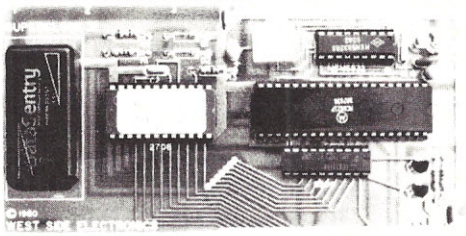
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This attorney successfully pleads the merits of this word processing system.

The Verdict Is In On Spellbinder

By Steven Guralnick

In the March 1980 issue of *Kilobaud Microcomputing* ("Do the Job for Less," p. 110), I described an Exidy Sorcerer word-processing system that my law office uses for letters and documents. I'm back, to describe Spellbinder, a disk-based software package.

While my original article was about the Exidy ROM PAK, Spellbinder runs under either CP/M or Oasis on a wide variety of computers, terminals and disk formats. Its manufacturer, Lexisoft, advises that it will run on standard CP/M with the ADM-3A, Hazeltine 1500, Intertube II, Heath 19, Soroc 120, TVI 920, Zantec Zephyr, Cromemco 3102 and Visual 200 terminals. They also say that it will run on special configurations of CP/M with the Exidy, Vector Graphics, Cromemco, TRS-80 II (Pickles & Trout), Superbrain and the Heath WH-89 computers.

Our computer has 48K of memory. A hardware modification lets us run with 56K of RAM. The extra memory is located in an Integrand Data S-100.

We're using one Micropolis Mod II drive. We expect to add a second soon, although one of Spellbinder's fine features is its ability to operate with only one drive.

INDENT	CURSOR MODE	CURSOR ↑ UP	MODE DELETE
EXPAND CLOSE TEXT	← CURSOR LEFT	REWRITE	CURSOR RIGHT →
SCAN CURSOR	MODE BKWRD	CURSOR ↓ DOWN	MODE FWARD
EDIT COMMAND	SOFT HYPHEN	CLEAR DELETE	DELETE TEXT

Fig. 1. Editing commands on the touchpad.

Our system also includes a Diablo 1620 printer with a keyboard. We're using the CP/M furnished by Exidy.

Editing Functions

I refer you to my original article for a description of the basic editing functions. (A back issue is available from *Microcomputing* for $3.)

When Spellbinder is booted, you are given some options about help messages. These provide you with a list of commands that might be used at a particular time; they are useful for a short period until you learn the program. Subsequently, they can be discarded, and the entire screen, less the top message line, can be used for displaying text.

The basic editing is similar to the Word Processor Pac and has been modified by the addition of a cursor mode feature. By pressing a key on the touchpad (see Fig. 1), or a control key combination if you are using a control key version, you change the cursor mode to PARA (for paragraph), CHAR (for character), SENT (for sentence) or WORD. Once that mode is set, three additional keys called MODE DELETE, MODE BACKWARD and MODE FORWARD operate the function consistent with the cursor mode setting.

For example, if the cursor mode is in PARA, MODE DELETE will remove a paragraph, MODE FORWARD will jump the cursor forward a paragraph and so forth. The ability to delete individual characters remains.

Another new function called REWRITE makes the line the cursor is on the top line on the screen. Otherwise, no significant changes have been made to the basic editing I described in my earlier article.

Incidentally, Arkay Engravers (2073 Newbridge Road, Bellmore, NY 11710) still furnishes specially engraved keys for a number of terminals, and has added the new keys for Spellbinder.

The basic gross commands, such as search and replace, delete, paragraph transfer and so forth, are essentially as I originally described them.

It is after we get past basic editing that our office makes use of the power of this program.

Disk Routines

The disk routines are easy to understand and very versatile. There are two levels of disk commands: a global set, which is simple to use and manages an entire file; and a more molecular set, with which you have complete control over all disk operations and can process any amount of text.

The global set is what we use most of the time to write letters and other documents. It is used when we create a document and want to put it on disk or when we take an old document, make some changes, and then put it back on disk. It is almost impossible to make a mistake when using this set; all you have to be aware of is that you use the command G when you want to get text and GD when you are done with either entering the text or with editing.

In the molecular set, each operation can be independently specified. It is the set that you must use in performing fancier operations. You could, for example, easily create a new file that contains parts of several old files. The GD command in the global set can be implemented molecularly by opening a write file, writing

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the text from the top to the end of the file into the open write file, closing the write file and deleting text from work space.

Disks can be changed at any time. If a new disk is inserted, it is read only and cannot be written to. However, the Q command displays the directory and, in addition, puts the new disk into a read/write status. The text remains in the work space during this process and can then be written to the new disk. Because of this feature, you can use one drive, substantially lowering your initial investment.

If a file is written with a filename which is already on the disk being written to, Spellbinder will automatically rename the earlier version with the same file name but with an extender of .BAK. Having that backup file available to us has, on several occasions, saved us from some real disasters from user error.

Get text—You may want to edit a file that is bigger than work space. All you need to do is enter the command G. The program will then request the read filename and drive designator. When that has been entered, the program will ask for the write filename of the new file and the drive designator (which can be the same drive). When that information has been entered, Spellbinder will automatically get text from the read file into the work space to an equivalent of about one-half the work space and then return control to the user.

When editing is finished on that section, typing G for the second time sends the text in the work space onto the write file and then brings in the next block of text for editing. This continues for as long as you wish. When you're done editing, you enter GD ("get done") and the program automatically reads from disk and writes to disk until the last of the read file has been completely written to disk. Then the write file is automatically closed. You can also add additional read files to the chain before executing GD.

Global searching—With the addition of the letter G to a search command, the searches or searches and replacements with a big file are trivial. For example, one of the functions we use often with large files is SG/STRING, where STRING is a specific string of characters you are trying to locate. If all you want to do is find the string, you need only open up a read file before entering the SG command. Then, Spellbinder will start to read in the file from the disk.

If it cannot find the string, it will empty the work space and bring in more text, continuing this process automatically until it finds the string, at which point it stops, positions the editing cursor at the beginning of the string and returns control of the system back to you. Then, you can work with the text, continue the search or just close the read file.

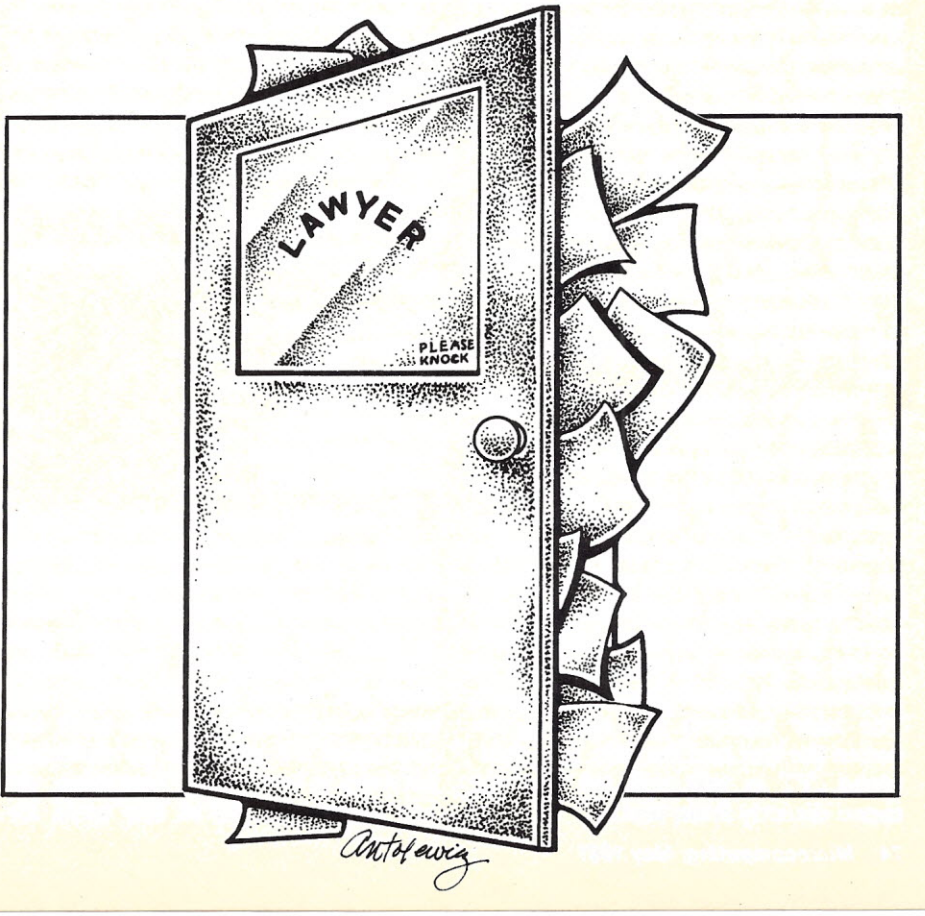
If the point is to make a change in the text, then first a read and write file are opened (which can be the same names), and you can enter a global search and replace command. Depending on the command, the program will either automatically go through the file and make the replacements, writing the changed file to disk, or it will stop on each requested string and give you a chance to decide on whether the change is to be made. When the decision is made, the program continues to read, search and write until the entire file has been worked on or until you indicate that the process is over.

Global printing—To print a file larger than the work space, you open up the read file to be printed and then enter PG. The program brings in a block of text, prints it, empties the work space, brings in another block, prints it and so forth. During the routine, all line counts and other printing counters continue uninterrupted. If desired, a write file can be opened and the file, after printed, can be written to the disk. This is very helpful if you anticipate changes during the printing process.

Global verification—If you wish to verify a file before printing (to check for hyphenation errors, line length errors, etc.), then you enter the command VG. The text is then scrolled on the screen. This is not really the correct terminology since the text is actually printed, but at the last step, the printing is directed towards the screen instead of the printer. This lets you see the effect of any embedded format commands, page breaks, etc.

If there are errors in the text, the scrolling stops, and Spellbinder points out the error. If you have used the G command prior to VG, the text moves from the read file to work space, where any corrections are made, to the write file, which is now ready to print. If the G commands are not used first, no files are opened and just the text in the work space is verified.

Verification is not necessary prior to printing, but it is nice to see the results before committing them to paper and to get the bugs out of your document before turning the printer on. We use this feature often because, among other things, it tells us how many pages will be printed, necessary for certain documents which refer to the total number of pages in the document itself (e.g., a title which



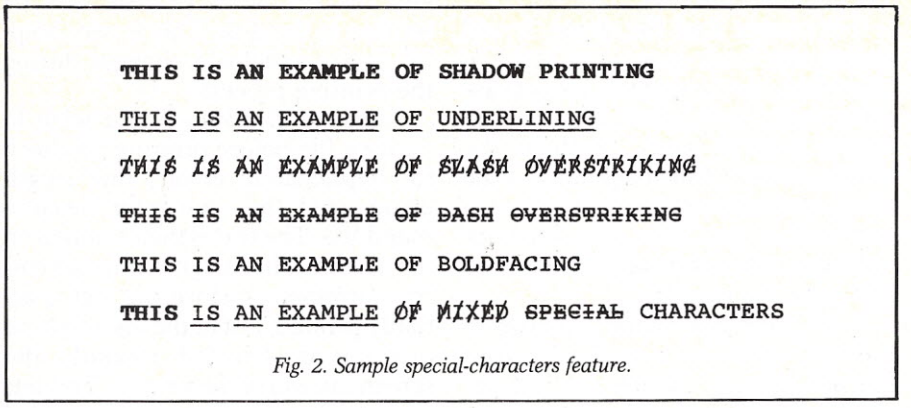


Fig. 2. Sample special-characters feature.

reads "Page 6 of seventeen pages").

Printing Functions

Describing the printing routines of Spellbinder is a little overwhelming because there are so many of them and the choices are so extensive. I will describe them in the context of how we use them with our Diablo printer.

To my knowledge, our Diablo is capable of no function that cannot be ordered from the software by direct commands—even a change of ribbon color. The software authors claim that this is also true for such printers as the Qume, the NEC Spinwriter and the Sanders.

For the user who wants only basic printing, the basic menu provides all of the tools. Line counting includes spacing between the lines, so a change in a document from single spacing to double spacing causes no problems. Other features include the selection of either the number of characters per line or the width of the line in tenths of an inch, the number of line feeds at the end of the page (to set up spacing between the pages), and so forth, all the features one would expect with a sophisticated word processor. Even if the user has a nonprecision printer, Spellbinder will help set up a good-looking printout.

Titling is versatile and sophisticated. From a menu accessed by the command YT, the user can title (up to 80 columns wide) at the top and/or bottom of a page. The starting page number is user-selected and can be located anywhere across the page, and the location can be changed depending on whether the page number is odd or even, for certain kinds of manuscripts requiring this feature. The user controls the spacing between the text and the title. The command .YT in text will set the title menu directly from text.

We have used this program to create beautiful documents—documents we are genuinely proud of—by using its ability to precision-print, including justified text, and to produce such features as bold-facing and shadow printing.

The precision printing of a document (which, incidentally, is done bidirectionally on our Diablo) is controlled by the printing menu, accessed by the command Y. I want to emphasize at this point that any command which can be entered manually in the menu can also be embedded in text; therefore, formats, or any factor in the format, can be changed as the text is being printed. Also, because the format instructions can be embedded in the text, the text can be set up initially with format instructions and then run repeatedly without the necessity of rekeying the instructions.

The first half or so of the Y menu is used with any kind of printer and covers settings for line feeds between the lines, line length, left-hand indenting and so forth. It is the second half which is used primarily for precision printing. Of course, a precision printer is required.

The lower half of the Y menu looks like this:

RIGHT JUSTIFY _____
LF SIZE-48/IN _____
CHAR SIZE-120 _____
SPECIAL CHAR _____
PROPORTIONAL _____
MAXIMUM SPACE _____
MINIMUM SPACE _____

To the right of each entry, a default number appears when the program is booted. You can custom-set these default numbers so the table will come up the way you want it when you boot up Spellbinder. Incidentally, there are two of these Y tables; they can be switched between with the command YS and can be switched between in text. In our operation, we use default values in one table for tractor-fed drafts of documents and the other for letterheads. The user can also set the tab tables, a character-spacing table and the title table as part of the personalization process.

The first item is right-justification of text. A setting of 1 turns on that feature; a setting of 0 turns it off. I will describe right justification later.

The next item is the size of the line feed in 48ths of an inch. Normally, we set this at 8, which produces a line spacing of 1/6 of an inch or six lines to the inch. We sometimes change it to 7 when a letter is a little too long to fit on one page. It's amazing: the reader never notices, but our secretary appreciates it!

The next entry is character size; i.e., spacing between the characters, in 120ths of an inch. Our usual setting is 12, which produces a one-tenth of an inch spacing or ten characters to the inch. We change this when working with elite type.

The next entry is the so-called special character setting. It is one of the truly fine features of this program. The way it works is this: the user enhances the text to be specially treated. (The enhancement is done on our system by either reversing the video or by beginning and ending the text to be enhanced with a tilde [~].) When the program encounters enhanced text, it immediately queries the special character setting extant in the Y table at that moment, and then, depending on what the setting is, will print the enhanced text in shadow printing, bold facing, with slash overstrike, with dash overstrikes or underlined. It will also insert spaces where the enhanced text is, send nulls or disregard the enhancement.

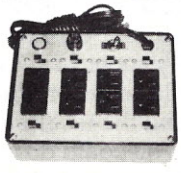
The special character setting can be changed at any time by embedding in the text an !, followed by a number from 1 to 7. Thus, it is possible to underline a word and shadow-print another word in the same sentence and do it as the printing takes place, without user intervention.

An example of some of the different types of enhanced printing is shown in Fig. 2.

The next entry is proportional print, which is turned on and off by the same method used for justified printing. I will describe it later.

The last two items in the menu set the minimum and maximum spacing between the words and must be set properly when text is to be printed with right-edge justification. The user sets X for maximum and Y for mini-

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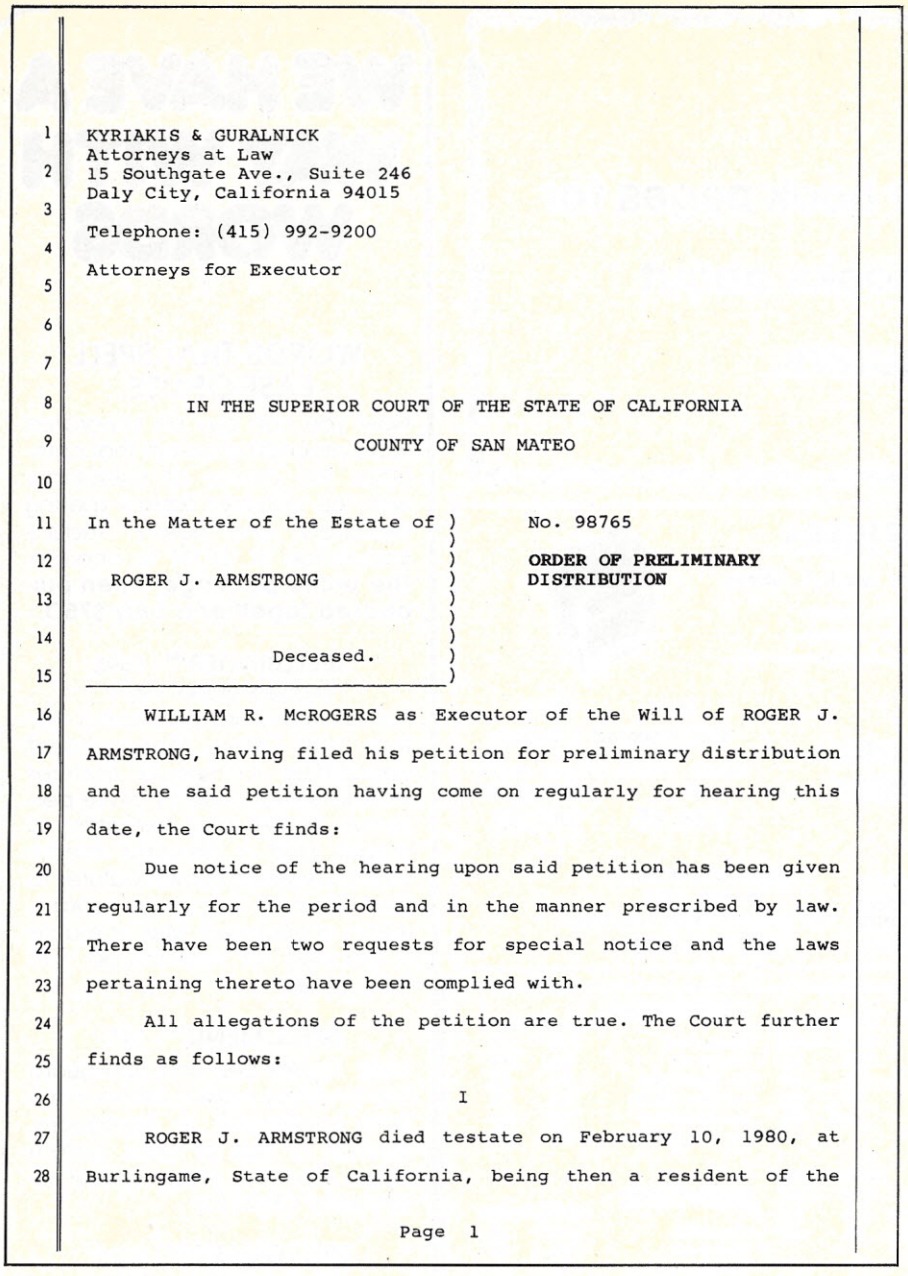
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IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

COUNTY OF SAN MATEO

In the Matter of the Estate of ROGER J. ARMSTRONG, Deceased. — No. 98765 — **ORDER OF PRELIMINARY DISTRIBUTION**

WILLIAM R. McROGERS as Executor of the Will of ROGER J. ARMSTRONG, having filed his petition for preliminary distribution and the said petition having come on regularly for hearing this date, the Court finds:

Due notice of the hearing upon said petition has been given regularly for the period and in the manner prescribed by law. There have been two requests for special notice and the laws pertaining thereto have been complied with.

All allegations of the petition are true. The Court further finds as follows:

I

ROGER J. ARMSTRONG died testate on February 10, 1980, at Burlingame, State of California, being then a resident of the

Page 1

mum, where X and Y are the user's choices of parameters. These settings then tell the computer to tell the printer that in a given line there are to be no more than X/120 of an inch total spacing between the words and no less than Y/120. You can see that varying these settings will produce a much different-looking document.

It may be completely impossible to print the line as you have specified without hyphenation. If so, Spellbinder will then find the word that must be hyphenated to correct the problem. This completely eliminates the problem of excessively large gaps between words that you sometimes see with justified text.

There are now a series of dot commands. By entering a decimal point at column zero, followed immediately by a letter, various essential functions are carried out. For example, .C automatically centers the text which follows on that line; .H makes that line a title; .S stops the printer; .E sends a form feed to the printer when encountered. There are several more which do negative line feeds, negative page feed and so forth.

Justification of documents is a feature we use in our operation very often. It produces elegant results, especially in court pleadings, which have a black vertical rule on both sides of the text. It is not necessary to use proportional printing to obtain justification, but the use of the precision routine gives you the proportional spacing between the words.

Incidentally, the use of proportional spacing produces a document which is essentially tamper-proof. You cannot put that document into an ordinary typewriter later and change words; the spacing doesn't come out right. You would have to use the same precision printer and know precisely the maximum and minimum settings originally used. For that reason, we use this feature in any document where the integrity of the instrument is essential; wills, for example.

For proportional printing you should have a wheel or thimble with proportional characters. We do not at the moment because our printer only handles plastic wheels, and there are no plastic proportional wheels suitable for our operation. But we expect to have the capability soon. I can say that I have seen Spellbinder produce proportional print, and the results are as good as anything you could do in a printer's shop.

Titling can also use the precision routines. When a title turns up in the document (prefaced by a .H statement), the program loads the title into a special buffer and sets up the title on the basis of the Y menu settings extant at that moment. A change of format for the text can then follow. Therefore, it is possible to have entirely different character spacing or length for the title than for the text that follows.

After a document has been set up for precision printing, the user can then enter V and the program will scroll the document on the screen, as I have described above under the global verify section.

To summarize, the printing routines that can be used with Spellbinder are extensive and useful, and give a genuinely professional look to every document which leaves our office.

Macroprograms and Macroprogramming

Every user has some special needs for features that are too unique to be included in a general-purpose program. Spellbinder provides a means to handle these needs. This is done with a command that executes any sequence of commands. The sequence can be entered from the keyboard or, if the series is long, it can "load and go" directly from disk.

To take a simple case, suppose you have a customer file in which each record consists of eight lines, and you want to scroll from record to record.

The normal way is to issue the command F8, followed by a carriage return. That takes the cursor forward eight lines in text. But, if 100 records need to be monitored, that would be 300 keystrokes.

The alternative is the command 1000 F8/I. (The I command halts execution and waits for the user to tap the space bar before executing again.) The command sequence says execute the following command 1000 times or until the end of the file is reached: go forward eight lines and wait until the user intervenes. Then, all that is necessary to go from record to record is a tap of the space bar.

The command sequence, or macros as they are called, can be much more complex. One problem in any law office is keeing track of time spent on a particular client. I set up a basic timekeeping operation with the ROM PAK and worked with it for about a year. It took me only about an hour. However, with Spellbinder, a colleague of mine and I are reworking the macro extensively. It will prompt on the screen, keep the client records in alphabetic order, automatically sum up without my having to resort to a four-banger, and give me a report at the end of the month. If I were a programmer, I could have done this in BASIC or assembly language, but I would not have because I would have had to learn the language. Also, I have the advantages of the Spellbinder editor.

The Spellbinder package comes equipped with several macroprograms ready to go, including a set which automates a "mail room" function. They include a mail merge program, which lets you merge a standard letter automatically with a list of names and addresses; a sort program, which will sort names, addresses and zip codes; and a "cuesort" program, which lets you set up target lines on your files and then sort them out on a preselected basis.

This is a particularly powerful program and lets you set up customer lists, and then extract selected information. We use this program regularly with our master client list. We can rapidly sort out all the will cases, all clients to receive Christmas cards, the date when a client first came to see us and so forth. We can then mix the extraction process, and the program will tell us every will case which came to our office in June 1978. Should we desire, we could send letters to everyone on this list with the mail merge macro. This is an important ability for operations doing a lot of mailings from standard lists.

The sorting program Alpha will sort on any aspect of a customer record. It will sort a mailing list in alphabetic order by last name, ascending order of zip codes, by states or even by their street addresses.

Another macro, the forms handler, lets you generate a form, save it on disk and subsequently fill in the form repeatedly.

In addition, other macros let you set up boilerplate documents from a master file, which is useful for letters, legal documents, or, perhaps, an instructor setting up examinations from a master question file.

A batchprint macro lets you list any number of files to be printed while you go out to lunch. There is a two-column printing macro which prints a line in the first column and then jumps to column 2 to print the corre-

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sponding line far down in the document. I understand that the Spellbinder manual was printed with this macro; it is very close to typeset quality and has a great deal of formatting.

Spellbinder is now being billed as a word processor and office management system. The printshop quality and mailroom functions would appear to justify that.

Assembly Language

For those of you who write assembly-language programs for CP/M assembly, Spellbinder lets you write the program, using all editing features. Then, the file is written to disk with an additional number after the write file name, and the file can be read immediately by the CP/M assembler.

Conclusion

As I pointed out in my original article, our office pours out tons of paper, and the entire operation is centered around our microcomputer, now equipped with Spellbinder. If it has drawbacks, I have not found them. You only need to pay attention to the documentation, which now includes an excellent tutorial.

We have trained two secretaries on this system, neither of whom had ever worked with a microcomputer before, and both of whom were then able to produce strictly professional material. We cannot speak highly enough of this software and commend it to anyone desiring to set up a fine word-processing system.

More information can be obtained about the software from Lexisoft, Inc., Box 267, Davis, CA 95616.■

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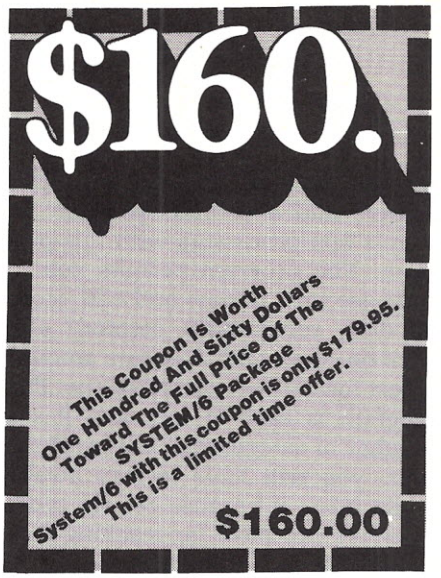
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The author shows you how to get started with text composition on your Apple II.

A Simple Text Processor

By Henry Simpson

If you have an Apple II with disk drive and a printer, you can do simple text processing with this program. The program permits you to compose text, review and edit, store on disk, recall from memory and print on command. A certain amount of text formatting is possible, too. The program is easy to use, and has a number of safeguards built in. However, you will have to stay awake while using it because certain types of errors can have far-reaching consequences (i.e., they can be disastrous).

With minor modifications, the program will work on other computers. They must have a GET command that permits retrieval of a character from the keyboard without a return. In some BASICs, this command is called INKEY$. It must also permit use of string arrays. NonApple users will note some peculiar commands in this program—Apple-specific commands are described briefly at the end of the article.

Program Design

Program design is straightforward. The program permits you to compose text at the keyboard. As you compose, keyboard inputs are assigned to the elements of a character string array. Array A$ has 500 elements, each 240 characters in length. Once text is "in" A$, it can be manipulated, stored, retrieved or printed out at will.

Menu Options

Perhaps the simplest way to describe program operation is by covering each of the menu options in turn. Later on we will cover how the program works.

When the program is first run, the menu appears on the screen. The menu has six options: WRITE, REVIEW/EDIT, READ FROM DISK, WRITE TO DISK, MAKE HARD COPY and QUIT. Array A$ is "empty" when the program starts. You can write into the array by selecting option 1 (WRITE). Or, if you have previously written to the array and saved it on disk, you can select option 3 (READ FROM DISK) to load the array and pick up where you last left off.

Let us assume that you start with option 3. This calls up a subroutine which loads A$ from a sequential file on the disk.

WRITE Display

Once the array is loaded, you select menu option 1 (WRITE). The program reads through the array to find the first empty element so that you can continue writing from where you last left off. The screen then goes blank and the number of the first empty element appears in reverse video at the upper left-hand corner. Having brilliant recollection, you know exactly what you last typed in, and you type merrily away until you use up 240 characters. At this point, the program inserts the number of the next empty array element in your prose string in reverse video, and you automatically continue writing into the next element of the array. You can continue typing along this way until you use up all memory.

For reasons that will be described later, you cannot use cursor keys and must use a CTRL-B command to back up to correct data entry errors. Each CTRL-B command backs up the cursor one space, letting you write over the incorrect entries.

By pressing the return key, you move from one array element to the next. By pressing the return key twice, you return to the menu.

Formatting is possible by putting a control character in the first character position in the array element. To start a new paragraph, for example, press return once to move to the next array element, enter a CTRL-P command, and then begin typing. When the first element is later scanned for printing, the CTRL-P ASCII code will be recognized and the array element will be indented five character spaces from the left margin.

CTRL-S causes a line skip and printing to begin at left margin.

CTRL-R causes printing to begin at left margin on next line.

Use of these control characters may seem confusing, but once you get the hang of them they're easy to use. Control characters are a simple way of attaching information to text so that the information is invisible during printout.

When you finish typing your prose, press the return key twice to return to the menu.

Now that the prose is loaded into the array, it can be saved to disk by selecting menu option 4 (WRITE TO DISK), which calls a subroutine that writes the array to disk.

REVIEW/EDIT Display

To review and perhaps edit the prose you just typed in, you would select menu option 2 (REVIEW/EDIT). This lets you review the array, element by element, and make addi-

Address correspondence to Henry Simpson, Anacapa Sciences, Inc., PO Drawer Q, Santa Barbara, CA 93102.

tions, modifications and deletions. When you select menu option 2, the screen goes blank and the program requests the array element reference number. After you enter this and press return, the REVIEW/EDIT display appears. The array element string you selected appears at the top of the display, formatted down from line four of the display in accordance with any formatting instructions entered with control characters during writing. If the selected element is empty then the word "EMPTY" will briefly appear in reverse video and the upper half of the screen will go blank.

The REVIEW/EDIT display has five basic options.

Pressing the F key moves the display forward to the next array element. For example, if array element 101 is initially on the screen and the F key is pressed, then array element 102 appears. Holding the F and repeat keys down simultaneously permits you to slew forward through the array. Pressing the B key lets you move backward through the array.

Operation is similar to that for the F key. There are stops at array elements 1 and 500 to prevent you from going outside legal array element values.

Pressing the X key returns the menu.

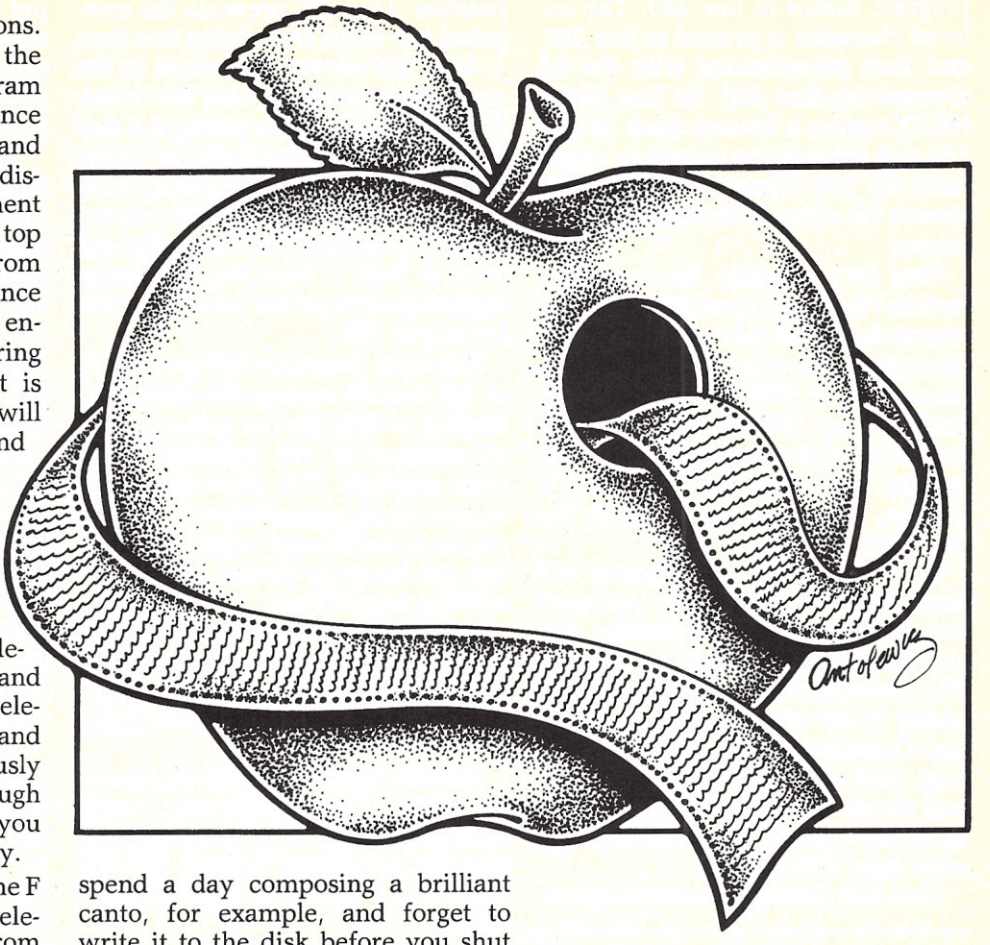
Pressing the D key deletes the displayed string.

Pressing the E key lets you edit the array element string. The cursor moves up onto the display so that you can write over the string from first character to last. You can do formatting with control characters and correct errors with CTRL B.

When you finish reviewing and editing, you can return to the menu by pressing the X key. Once back at the menu, you can select the appropriate option for your next move. Likely options after reviewing/editing would be to write to disk or, possibly, to make a hard copy.

On the other hand, if you were thoroughly disgusted with what you had written, you could cancel it by selecting option 6 (QUIT).

This little trip through menu options shows basically how the program operates. A number of things are fairly apparent but deserve emphasis anyway. First, the program is completely manual. You control what goes in and out of memory and how and when it happens. If you spend a day composing a brilliant canto, for example, and forget to write it to the disk before you shut your Apple down for the day, then you just discovered the meaning of human frailty. The same applies if you write an empty array to a canto saved on disk.



Some writers do a lot of cutting and deleting. At the computer this is fun—you get a genuine sense of exhilaration by wiping out blocks of prose with the DELETE selection on the REVIEW/EDIT display. This can, of course, be carried to extremes. This is, however, an individual matter.

How the Program Works

Let us start from the beginning of the program and then move through the various menu options.

Array A$ is dimensioned in line 20. Lines 30 and 40 define control characters used to switch Apple II disk drives and printers on and off. Line 50 defines a constant that is used in calculating available memory for Apple II in the subroutine that begins on line 70. Line 60 jumps the program to the menu, which begins at line 380. The intervening space is taken up with the data entry and display subroutines. The display is cleared at line 390, and the available memory subroutine is called at line 400. Menu options are then displayed.

Data Entry

When menu option 1 (WRITE) is selected, the program jumps to line 570. Lines 580 through 600 identify the next empty array element. The display is cleared and a FOR-NEXT loop begins at line 620. The array element number is printed in reverse video at line 630. Line 640 calls the data entry subroutine that starts at line 120. This subroutine is probably the most complex part of the program, so let's take a close-up look at it.

The A$ element is cleared at line 130. A FOR-NEXT loop is begun at line 140. Line 150 gets one character from the keyboard. Lines 160 through 190 recognize various control characters and take appropriate actions.

Line 160 recognizes a return and ends the FOR-NEXT loop.

Line 170 recognizes a CTRL-P and causes the cursor to skip down one line and over five spaces. Line 180 recognizes a CTRL-S and causes the display to skip a line and start at the left margin. Line 190 recognizes a CTRL-R and causes the cursor to skip to the next line and move to the left margin.

Line 200 recognizes a CTRL-B. If one is present, then the line 210–270 sequence is followed. Otherwise, the

program jumps to line 280. The entered character is printed at line 280, and then concatenated with the A$ element on line 290. At line 300 a NEXT causes a bounce back to line 140 and through the sequence again, until all 240 characters have been read or the string is terminated with a return.

Now let's consider the error-correction routine in lines 210–270. The reason it is done this way is that the characters are taken from the keyboard with a GET command. You can't use an INPUT command because one of the characters may be a comma, and whenever you enter a comma, the computer expects another input.

You can only get one character at a time. If you make an error, you can't simply back up with the cursor, correct the entry and then hit return. The last character has already been added to the string you were building. Consequently, you need to subtract that character from the string and move the FOR–NEXT counter back one notch. Those things are what lines 210–270 do.

Line 210 identifies current cursor position. Line 220 prevents the computed tab value from being less than 1. Line 230 moves the cursor to the appropriate position. Line 240 transforms a one-character string to a null string. Line 250 subtracts the rightmost character from the string. Line 260 backs the FOR–NEXT counter up by 1, provided that the initial value is at least 1. And line 270 jumps control back to get the correct character at line 150.

Note that lines 160–190 are optional. All they do is cause the data entry display to take on the same general appearance as the eventual hard-copy printout. This gives the writer an idea of the appearance of his final product. Additional control characters can easily be used to expand formatting capabilities.

Now that you have completed this key subroutine, jump back to line 650, which is where you would return to if you were a computer pointer.

Line 650 recognizes a blank character. When it encounters one, it ends the FOR–NEXT loop that began at line 580 and jumps through line 670 back to the menu. So much for data input.

Review/Edit

The REVIEW/EDIT program starts at line 680. The screen is cleared at line 690. The string array element number is obtained at line 700. Line 710 performs a range test, and returns to line 700 if the entered value is illegal.

Line 720 begins display sequence, a point that is returned to from a number of places within the REVIEW/EDIT display program. Line 720 sets the cursor to the upper left of the screen and clears the line. Line 730 displays the array element number in reverse video. The selected array element may contain a character string or null string. Line 740 tests for a null string. If one is not present, then control jumps to line 790. If a null string is present, then control runs through lines 750–780, which briefly display the "EMPTY" message and then jump control down to line 820, to present the lower portion of the display.

If the string array element is not empty, then the program goes to line 790, which sets the cursor to the fourth line down from the top and clears the lower portion of the screen. Line 800 calls the string display subroutine, which starts at line 320. This subroutine is as important as the input subroutine discussed earlier (and somewhat less complicated). The display subroutine is used not only at this point in the program, but also during hard-copy printout.

The display subroutine begins at line 320. Line 330 checks for a null string and returns if one is present. (This check is necessary during hard-copy printout to prevent lines 340–360 from attempting to dissect null strings.) Lines 340–360 test the leftmost character of the string for control characters used for formatting. Line 340, for example, looks for a CTRL-P. If one is present, then printing jumps down a line and indents five spaces from the left margin. Similar checks are done at lines 350 and 360. If no control characters are encountered, then line 370 simply prints the string. If no control characters are ever entered, then all of the various string array elements will be spliced together.

When the subroutine is completed, control returns to line 810. Lines 810–930 present menu choices and formatting reminders to the program user. The five available choices and their effects upon display were described earlier. These are fairly straightforward. The only one that may not be self-evident is the EDIT option.

If E is selected as the menu choice, then control jumps to line 1030. This moves the cursor up to the beginning of the displayed string. The data entry subroutine that we discussed earlier is called at line 1040. When this is completed, the program returns to line 720 to represent the display.

Read/Write Disk

Selection of menu option 3 and 4 calls a subroutine for reading or writing the disk. The form of these subroutines will be familiar to Apple users. The only possible odd wrinkle is that the controlling X$ character contains a RETURN along with CTRL-D. This avoids some of the problems that seem to dog the use of such subroutines when they are selected with a GET command.

Make Hard Copy

Selecting menu option 5 calls a subroutine that begins at line 1060. Line 1070 calls an additional subroutine that turns the printer on. Line 1080 starts a FOR–NEXT loop. Line 1090 checks both the current string array element and the previous one to see if both contain null strings. If they do,

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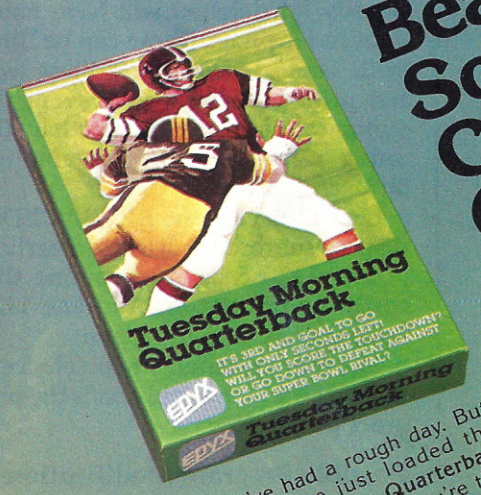
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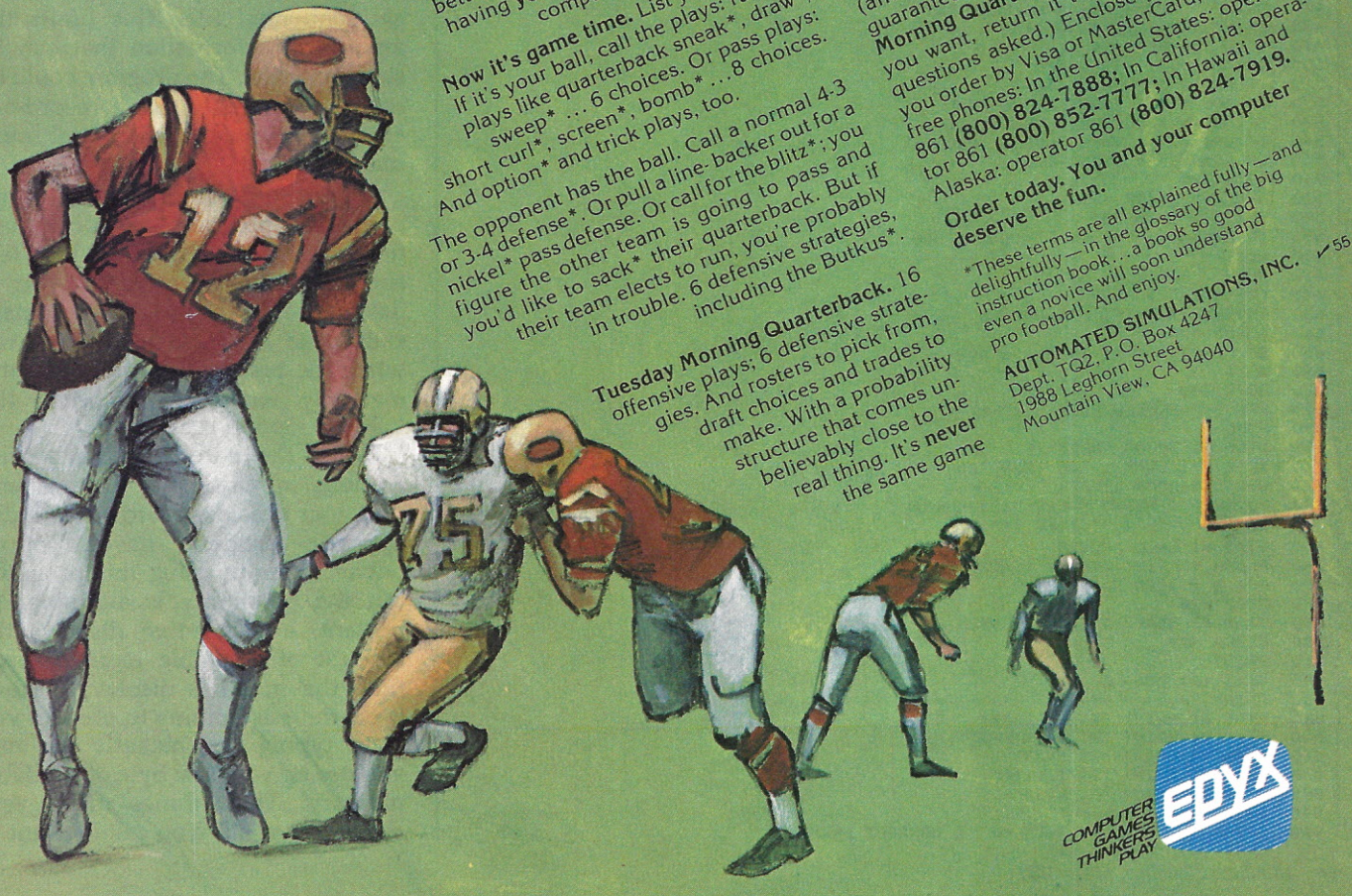
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Text Writer program in Apple II BASIC.

```
10  REM ----TEXT WRITER PROGRAM----
20  DIM A$(500)
30 X$ =  CHR$ (13) +  CHR$ (4)
40 Y$ =  CHR$ (9)
50 Z = 65536
60  GOTO 380
70  REM ----AVAILABLE MEMORY SUBROUTINE----
80 M =  FRE (0)
90  IF M < 0 THEN M = M + Z
100  INVERSE : PRINT "MEM: ";M: NORMAL
110  RETURN
120  REM ----DATA ENTRY SUBROUTINE----
130 A$(P) = ""
140  FOR N = 1 TO 240
150  GET B$
160  IF  ASC (B$) = 13 THEN N = 240: GOTO 300
170  IF  ASC (B$) = 16 THEN  PRINT : HTAB 5
180  IF  ASC (B$) = 19 THEN  PRINT : PRINT : HTAB 1
190  IF  ASC (B$) = 18 THEN  PRINT : HTAB 1
200  IF  ASC (B$) <  > 2 THEN 280
210 T =  POS (0)
220  IF T = 0 THEN T = 1
230  HTAB T
240  IF  LEN (A$(P)) < 2 THEN A$(P) = "": GOTO 260
250 A$(P) =  LEFT$ (A$(P), LEN (A$(P)) - 1)
260  IF N >  = 1 THEN N = N - 1
270  GOTO 150
280  PRINT B$;
290 A$(P) = A$(P) + B$
300  NEXT
310  RETURN
320  REM ----DISPLAY SUBROUTINE----
330  IF A$(P) = "" THEN  RETURN
340  IF  ASC ( LEFT$ (A$(P),1)) = 16 THEN  PRINT : PRINT  TAB( 5)A$(P);: RETURN

350  IF  ASC ( LEFT$ (A$(P),1)) = 19 THEN  PRINT : PRINT : PRINT  TAB( 1)A
     $(P);: RETURN
360  IF  ASC ( LEFT$ (A$(P),1)) = 18 THEN  PRINT : PRINT  TAB( 1)A$(P);: RETURN

370  PRINT A$(P);: RETURN
380  REM ----MENU----
390  HOME
400  GOSUB 70
410  VTAB 4: PRINT "SELECT ONE:"
420  PRINT "==========="
430  PRINT : PRINT "1. WRITE"
440  PRINT : PRINT "2. REVIEW/EDIT"
450  PRINT : PRINT "3. READ FROM DISK"
460  PRINT : PRINT "4. WRITE TO DISK"
470  PRINT : PRINT "5. MAKE HARD COPY"
480  PRINT : PRINT "6. QUIT"
490  VTAB 24: GET A0$
500  IF A0$ = "1" THEN 570
510  IF A0$ = "2" THEN 680
520  IF A0$ = "3" THEN  GOSUB 1140
530  IF A0$ = "4" THEN  GOSUB 1200
540  IF A0$ = "5" THEN  GOSUB 1060
550  IF A0$ = "6" THEN  END
560  GOTO 380
570  REM ----WRITE----
580  FOR G = 1 TO 500
590  IF A$(G) = "" THEN F = G:G = 500
600  NEXT
610  HOME
620  FOR P = F TO 500
630  INVERSE : PRINT P;: NORMAL
640  GOSUB 120
650  IF (A$(P)) = "" THEN P = 500
660  NEXT
670  GOTO 380
680  REM ----REVIEW/EDIT DISPLAY----
690  HOME
700  VTAB 4: INPUT "REF#";P
710  IF P < 1 OR P > 500 THEN 700
720  VTAB 1: HTAB 1: CALL  - 868
730  INVERSE : PRINT "REF# ";P: NORMAL
740  IF A$(P) <  > "" THEN 790
750  VTAB 4: CALL  - 958
760  FLASH : PRINT "EMPTY": NORMAL
770  FOR K = 1 TO 20: NEXT
780  GOTO 820
790  VTAB 4: HTAB 1: CALL  - 958
800  GOSUB 320
810  PRINT
820  VTAB 12: HTAB 1
830  PRINT "----------------------------------------"
840  HTAB 9: PRINT "F: FORWARD"
850  HTAB 9: PRINT "B: BACKWARD"
860  HTAB 9: PRINT "X: EXIT"
870  HTAB 9: PRINT "D: DELETE"
880  HTAB 9: PRINT "E: EDIT"
890  PRINT
900  PRINT "   CTRL B: BACK UP TO CORRECT ERROR"
```

More

then the program concludes that it is at the end of text, the FOR-NEXT counter is run up to 500, and the loop ends. This test is not very stringent and program users may want to change it. A heavy editor with a propensity for deletion will have many gaps in his prose. These can be filled with control characters; these will not print out, but will prevent the computer from thinking that the string array elements contain null strings.

Line 1100 calls the REVIEW/EDIT display subroutine discussed earlier.

Line 1120 calls a subroutine that turns the printer off. And line 1130 returns control to the menu.

The only remaining menu choice is 6 (QUIT), which simply ends the program at line 550.

Possible Program Modifications

This program has many of the features of a text processor, although in rudimentary form. You can take a number of steps to enhance its abilities.

Formatting, for example, is pretty simple at present. Only four formatting options are possible: Splice present string to previous, drop down a line and indent, skip a line and start at left margin or drop down a line and start at left margin. You may want to add capabilities.

At present, the program uses a single sequential file. This limits the amount of information that can be stored on disk. The program could be easily modified to use a record-oriented file to permit additional information storage.

A user seriously interested in applying this program to text composition might want to make it a little less subject to human error. One way to do this is have the program automatically read a file to load the array when the program is run, and automatically write to file when the "QUIT" option is selected.

One of the more important considerations in writing is making sure that your precious words do not disappear by accident. I haven't yet run out of memory using this program, but the possibility is alarming. At present, a subroutine displays the amount of available memory each time the menu is displayed. However, there is nothing to prevent you from typing nonchalantly on until you use up your last byte of available memory. Then things move very slowly, if at all. You might want to

add a memory check to the WRITE program to prevent running out while writing.

Note to Non-Apple II Users

Some of the commands in this program are probably unfamiliar. The following is a brief description of Apple-unique commands and can be used for program modification to suit other forms of BASIC.

FRE(0) displays the amount of available memory. POS(0) locates the cursor's present horizontal position. HOME clears the screen and moves the cursor to upper left. INVERSE causes the next print statement to print in reverse video; NORMAL returns to conventional video.

FLASH works like INVERSE but causes the printed information to flash on and off. CALL – 868 clears to end of line. CALL – 958 clears to end of screen. The subroutines starting at line 1140 and continuing to the end of the program with the X$ and Y$ are Apple II BASIC's peculiar way of controlling disk drives and printers. All these really do is turn things on and off. ■

Listing continued.

```
910  PRINT "   CTRL P: NEW PARAGRAPH"
920  PRINT "   CTRL S: SKIP LINE"
930  PRINT "   CTRL R: LEFT MARGIN"
940  VTAB 15: HTAB 24: INVERSE : PRINT "CHOICE?";: GET A0$: NORMAL
950  IF A0$ = "X" THEN 380
960  IF A0$ = "F" AND P < 500 THEN P = P + 1: GOTO 720
970  IF A0$ = "F" THEN 720
980  IF A0$ = "B" AND P > 1 THEN P = P - 1: GOTO 720
990  IF A0$ = "B" THEN 720
1000  IF A0$ = "E" THEN 1030
1010  IF A0$ = "D" THEN A$(P) = "": GOTO 720
1020  GOTO 820
1030  VTAB 4: HTAB 1
1040  GOSUB 120
1050  GOTO 720
1060  REM ----MAKE HARD COPY----
1070  GOSUB 1260
1080  FOR P = 1 TO 500
1090  IF A$(P) = "" AND A$(P - 1) = "" THEN P = 500: GOTO 1110
1100  GOSUB 320
1110  NEXT
1120  GOSUB 1300
1130  RETURN
1140  REM ----READ TEXT FILE----
1150  PRINT X$;"OPENTEXT"
1160  PRINT X$;"READTEXT"
1170  FOR P = 1 TO 500: INPUT A$(P): NEXT
1180  PRINT X$;"CLOSETEXT"
1190  RETURN
1200  REM ----WRITE TEXT FILE----
1210  PRINT X$;"OPENTEXT"
1220  PRINT X$;"WRITETEXT"
1230  FOR P = 1 TO 500: PRINT A$(P): NEXT
1240  PRINT X$;"CLOSETEXT"
1250  RETURN
1260  REM ----TURN PRINTER ON----
1270  PRINT X$;"PR#1"
1280  PRINT Y$;"80N"
1290  RETURN
1300  REM ----TURN PRINTER OFF----
1310  PRINT Y$;"40N"
1320  PRINT X$;"PR#0"
1330  RETURN
```


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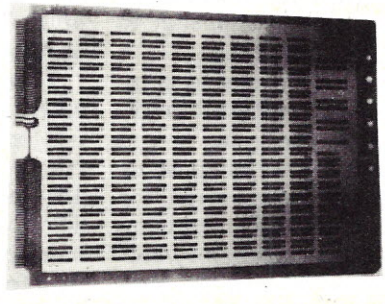
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This one-man advertising and public relations agency uses this North Star word processing system to handle all his business affairs, including keeping tabs on the President.

Norty, Ronnie and Me

By Edgar F. Coudal

Reporting President Reagan's move from the hills above Los Angeles to the White House proved just how much my electronic workplace means to me.

I'm the only employee of Coudal & Associates (the associates are fellow free-lance graphics people, photographers and writers, brought in project by project). I decided last year that as a full-time writer also working in advertising, public relations and other marketing communications, I needed to increase my output without taking on staff. I value my freedom to work 100 hours a week, or none, as I wish, and don't want to feel responsible to either boss or subordinate.

The obvious answer was to computerize the dungeon where I work, in the basement of my home.

It was the last electronic step, since I already depend on cassette tapes for interviews, an automatic telephone answering machine and call forwarder and completely electric 35 mm camera.

Since automation, I've increased my productivity by about three hours a day, without increasing my clock hours. And my appreciation for what computerization can do for a small business continues to grow.

The System

When planning my system, I knew that I needed the same kind of printing quality I got from my Hermes 808 typewriter. So I decided on an impact printer, with a daisywheel for changeable typefaces.

As for terminals, I ruled out anything less than 80-column display with a minimum of 24 lines on the screen. The full-page display terminals may be nice for someone dealing with one or two pages at a time, but since I'm generally dealing with 1500 to 5000 words, there was little difference between 24 lines and a full page.

Since I was going the full route—receivables, billing files, teaching the kids, mailing lists, form letters, proposals, contracts and especially word processing—I wanted speed, capacity and easy operation, with enough flexibility for applications that I knew I would think of later.

That meant disk drives, a micro a cut above game-player units, and at least 32K of memory (I later found that 48K was much more comfortable). The prices become formidable, at least for new equipment.

Then I got lucky. Prowling the classified ads, I came across the setup I use today, at half the price of retail—a North Star Horizon with a Diablo 1610 printer and a Soroc 120 console. The North Star was new to me, but I liked its speed. Also, a friend swore by it for teaching his high school computer classes, which spoke well of its durability, quality and ease of use.

As a daisywheel printer, the Diablo is not the fastest unit around. But the print quality, especially with film ribbons, is clearly superior to most printers, and equal to the rest. The Soroc occasionally produces keyboard signals to the computer that do weird things, and the ESC and RUB keys are located just below the return key, which also produces an occasional strange result. Still, I like the keyboard action and noise (remember, I'm used to a typewriter), and the display is quickly and easily readable, even with long hours on deadline.

I'm not arguing that this system is better than any other. But it does all I want, with quality and speed.

A word about my system disk. It resides in drive 2 and contains DOS, BASIC, the Secretary word processor, copy disk, copy file, compress disk and diskette check. (I never use a new disk without running a CK; and if the check code is not proper, the diskette gets pitched. I don't want it in the house. In fact, I don't even want it in the same county. One bad experience was enough.)

Further, that system disk contains four BASIC programs that let me get into type 3 data files and fool around with them directly. That's sometimes necessary, especially with the mailing lists. Finally, the system disk contains the North Star Monitor and the Ramtests. I have no compunction about letting my computer cook away, printing "M" all weekend, if it hasn't got something to do for me.

Word Processing

I've always been a pretty good first-draft writer. Fifteen years in the newspaper business taught me that. With five deadlines a day, you don't have a lot of time between blank paper and composing room. What the word processor does is take that first draft—which usually takes almost as long to write as a typewriter draft—and translate it into a final draft without the agony of cutting, pasting, retyping and redrafting. And that last look through the finished copy invariably finds a scrambled tense, or a mixed metaphor, or a pronoun without introduction, or some such gaucherie, the kind of thing you might live with, if it took more than ten seconds and a few control character key-

Address correspondence to Edgar F. Coudal, 627 S. Crescent Ave., Park Ridge, IL 60068.

strokes to correct.

I use Gary Young's Secretary word processor, which was reviewed in these pages in January ("Word Processor for the North Star Disk System" by G. L. Haller, p. 164), and find that it does a remarkable job. Input without carriage return is of particular joy. The text wraps around automatically by pushing down the last word on the line, if it won't fit, to the beginning of the next line.

Another key feature of Secretary is its ability to move lines or blocks of type, the ability to append existing files (more on that when I get to the Reagan move), and the global, or selective, search and replace features. The command language incorporates the powerful North Star Line Editor commands, which makes it remarkably simple to learn and use.

It's also inexpensive, available for less than $100 from Young, or from American Square Computers (Kivett Drive, Jamestown, NC 27282). That includes a simple and direct manual that does everything except tell you to turn on the processor.

Keeping Track of Business

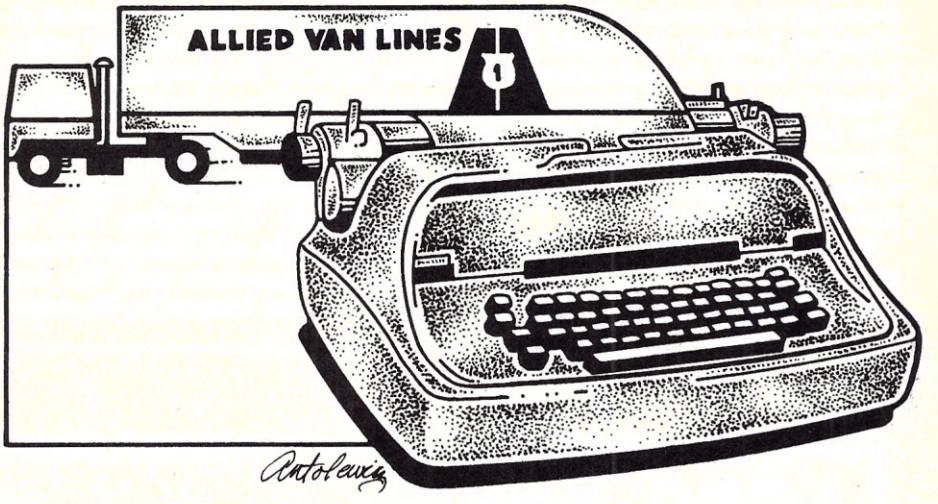
Keeping track of my work was one of the big annoyances of being in business for myself. Paper proliferated, file cabinets filled, things got lost and nothing was ever thrown away. Not anymore. My entire working life is in eight 5-1/4-inch diskette library cases on the shelf over the console. One case is marked "Permanent files," and is for material that I want to hang onto for a while—completed stories that can eventually be reworked for another magazine; correspondence; copies of proposal letters, letters of agreement and contracts; invoice copies and tax matters; and my exchange of nasty but entertaining letters with bank credit card issuers.

Two other cases are marked "Clients." Some of the permanent file is duplicated on these disks, but the Clients disk files are the second-stage working disks. Segregating the files by clients makes things easy to find, and makes the information on those files immediately accessible for other projects I might be doing for the same client.

Another case is marked "Working Files." This is work in process, story drafts, completed stories or other work that is out somewhere for approval by a client, acceptance by an editor, or just waiting for me to stop procrastinating and finish it.

A fifth library case contains perhaps the two most important disks, plus a handful of utility disks. The two key disks are the TODO/CALENDAR disk, which includes a complete listing—two lines each, with deadlines—of everything that must be done. When I think I'm caught up, there's always that disk to review. It also contains a calendar schedule for the next six months, one month to a screen. I check both of those files every morning, first thing, without fail. And both are updated every evening, last thing, again without fail.

The second disk is the billing disk. Every bill stays on that disk until I receive payment. All billing letters, invoices, monthly retainer statements, and so on, go there. The nice feature is that you establish the format—address, salutation, invoice number position, even the proper places to enter the explanation of each charge—and every bill looks the same from month to month. People tend to be comfortable with things they recognize.



Another case contains factory diskettes, with a "don't ever touch or use" label. Still another case is marked "Misc." and contains a flock of disks which were obtained one way or another, and might have something useful—maybe. Then there's the kids' box, with their own private diskettes, and finally, the "Games" box. It's not all work, you know. Anyone have any idea what the "Magic Zero" is all about in Cave?

A couple of hints about diskette files:

1. Have two copies of everything. If you only have one copy, it will destroy itself in the middle of the night.

2. Save constantly, for the same reason. A gremlin is always waiting to freeze the keyboard if you're 1000 words into a piece, and you haven't SAVEd it.

3. Hard-copy the DOS directory of each disk regularly, and paste it on the disk jacket. Then replace it regularly.

4. I have an hour early every Sunday morning to do nothing but go through *all* the disks, destroy files and then compress. The stuff that looked like it was for the ages when you created it last month usually isn't worth saving. Be ruthless.

Mailing Lists

A few of my clients live by mailing lists. Good publicity is truly a function of good mailing lists—reaching the right audiences. I use two programs. One is a spin-off of Secretary, and lets the user merge BASIC data files (type 3) with Secretary text files (type 7) and insert data lines in the text of a letter itself, through the simple use of up arrows. It's lovely for personalizing form letters, invitations, reminders of meetings and so on. But it's not very fast, and it's clumsy for such boilerplate as labels.

For a flock of labels to direct the mailing of a press release to metropolitan newspapers and trade magazines, I use a mailing list program I've adapted from the venerable Disco-Dex system (which is really a Rolodex on computer). It searches and edits for 12 variables, including credit rating and phone number. It does let you put in odd things like type of activity, which is essential in breaking down a trade magazine list into specific outlets for specialized products.

Mailing lists are a bother to maintain, but if you have kids around, make them learn to type and pay them some paltry sum per correct label. The lists will take care of themselves. Besides, they'll learn how to

use the computer for more than blasting Klingons.

It all adds up to a few rules I try to follow:

- Save regularly, especially in creation.
- Destroy just as regularly.
- Pitch any questionable diskette.
- Run regular tests of drives and memory.
- Upgrade your system whenever you can afford it. (The new 16K board cost me $400, but I don't know how I got along in that smaller memory.)
- Keep track of what's where.

President Reagan's Move

How all this comes together is shown in the coverage of the move of President Reagan's household goods from the Pacific Palisades above Los Angeles to the White House. Allied Van Lines, one of my clients, was chosen to handle the job. Obviously, a move of this sort had enormous positive news potential.

After visits to California and Washington, DC, to cover both ends of the move, and interviews with key people involved, the actual job of producing the news stories began. A number of factors come into play here, but how the word processing capabilities of Norty (or Noreen, as my wife calls the North Star) helped may be instructive.

> It was. . . done in perhaps 50 to 60 percent of the time it would have taken without Norty.

The basic release ran eight paragraphs, and covered the move in straightforward fashion. It went to all the Allied "peer" press, the magazines read by the household goods moving industry—*Transport Topics, Traffic Word* and numerous others.

Next were major daily newspapers in four metropolitan areas—Los Angeles and Washington, DC, of course, Omaha and Chicago (where Allied's headquarters are). The Los Angeles release focused on the origin agent, who also had moved Mary Tyler Moore, Bob Hope and many other notables. After five paragraphs and a transition, the Los Angeles story picked up much material used in the first trade press release.

Similarly, the Washington, DC, story focused on the destination agent and his role, and by appending existing files, and editing them, I completed the story.

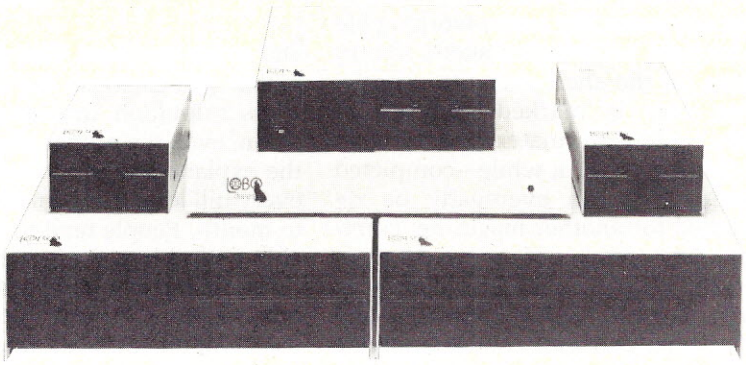
I wrote new lead material for the Chicago story, quoting top Allied executives, and again picking up previously-written general material on the move: the route, the time, how Allied was selected and so on.

Much of the same material was used in the Omaha newspaper story. Omaha is the base for Allied's sophisticated telecommunications network. Route plotting and the progress of the truck were monitored carefully from there, creating a strong local tie-in.

In a time when trucks are not viewed with the same fervor as they once were, the highway specialty magazines were a useful outlet for coverage of the move, again using much of the previously written mate-

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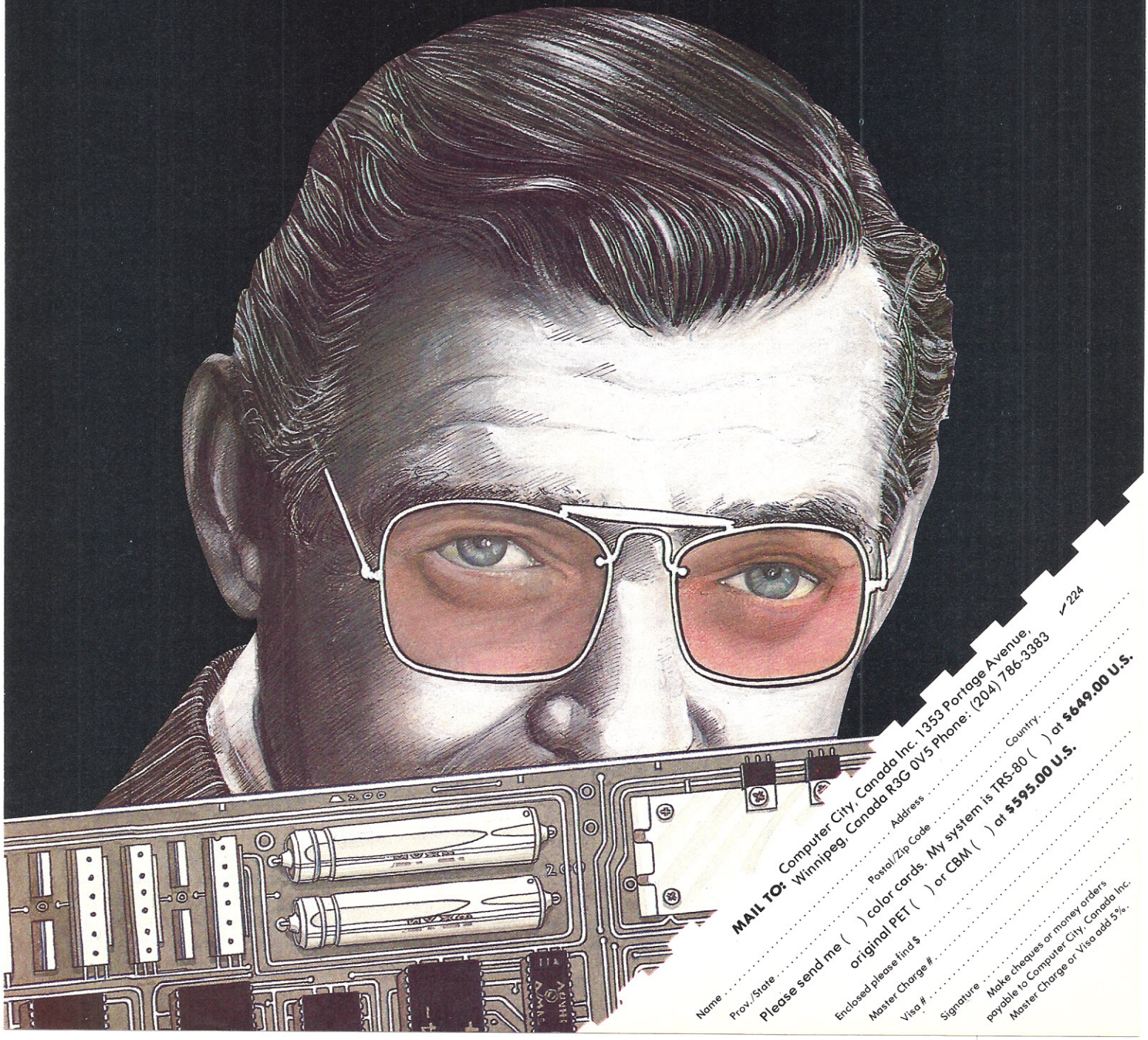
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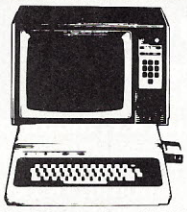
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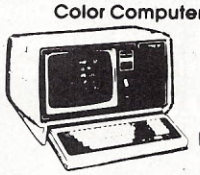
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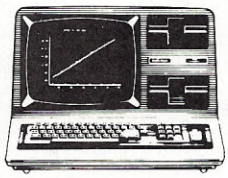


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RGNTRADE —The basic "peer" press story.
REAGANAD —This was additional material, appended to the above.
REAGCPTN —The President graciously posed for a photo with all the Allied personnel involved. This was the caption.
RGNCALIF —The California version of the new story.
RGNWASH —. . . and the Washington version. . .
RGNCHI —. . . and the Chicago variety. . .
RGNOMAHA—. . . and the Omaha release.
O/OGILL —The Driver feature for *Owner Operator* magazine.
O/OBUCH —A memo to Allied regarding the story. Buch is a person.
O/OCPTN —Nine captions to support the *Owner Operator* photos.
O/OSUBMT —Transmittal letter to the magazine.
OWNOPRTR —Letter confirming exclusivity of the story.
JET-GILL —Personality feature for *Jet* magazine on the driver.
JETCPTN —Captions for the *Jet* photos to support story.
JETSUBMT —Transmittal letter to the magazine.
RGNSHILD —The feature story for Allied's external magazine.
INSSHILD —A few late paragraphs for RGNSHILD. (You can't think of everything the first time around.)
ALLIED —An interim report on progress.
BUCHLTTR —A final report on what was done.

Here's what the writer's diskette, containing the many stories about the Reagan move to the White House, looks like.

DOS Directory printout.

rial—virtually word for word.

The mailing lists were broken down by zip code sorting for the newspapers, and by type of activity for the magazines. It went quickly and smoothly, timeliness being important to these first efforts.

Narrowing down a bit, the driver selected for the move was Allied's "Van Foreman of the Year," a high honor among the 5000 men who drive for Allied. An independent operator, under exclusive contract to the Allied destination agent, Sam Gilliam thus became the subject of a personality feature for *Owner Operator* magazine, and a strong human interest feature for *Jet* magazine. Both stories were fresh and contained about 50 percent new material, but the general details of the move came right out of disk storage.

Allied publishes a fine external magazine, *The Shield*, and the driver and the move became the cover feature in the next issue of the publication. In addition, the driver story will be important in a future issue of a magazine Allied is planning for its van foremen. There are further uses for the material, which is now in the "Permanent" case, such as for a section of the Annual Report, for marketing collateral print pieces, for integration into videotape and slide presentations and for other electronic pieces.

It was a large effort, but one that was done in perhaps 50 to 60 percent of the time it would have taken without Norty.

Conclusion

Norty doesn't help me spell. He doesn't generate catchy leads, or know everyone's address, or make sure that a singular verb always follows a singular subject. What he does do is take away a lot of the drudgery—the redrafts, the cutting and pasting and fitting, the retypes.

Powering through a first draft is great fun, and seeing the final work, hanging together in some kind of reasonable order, and conveying some kind of information, or message, or emotion, is most satisfying.

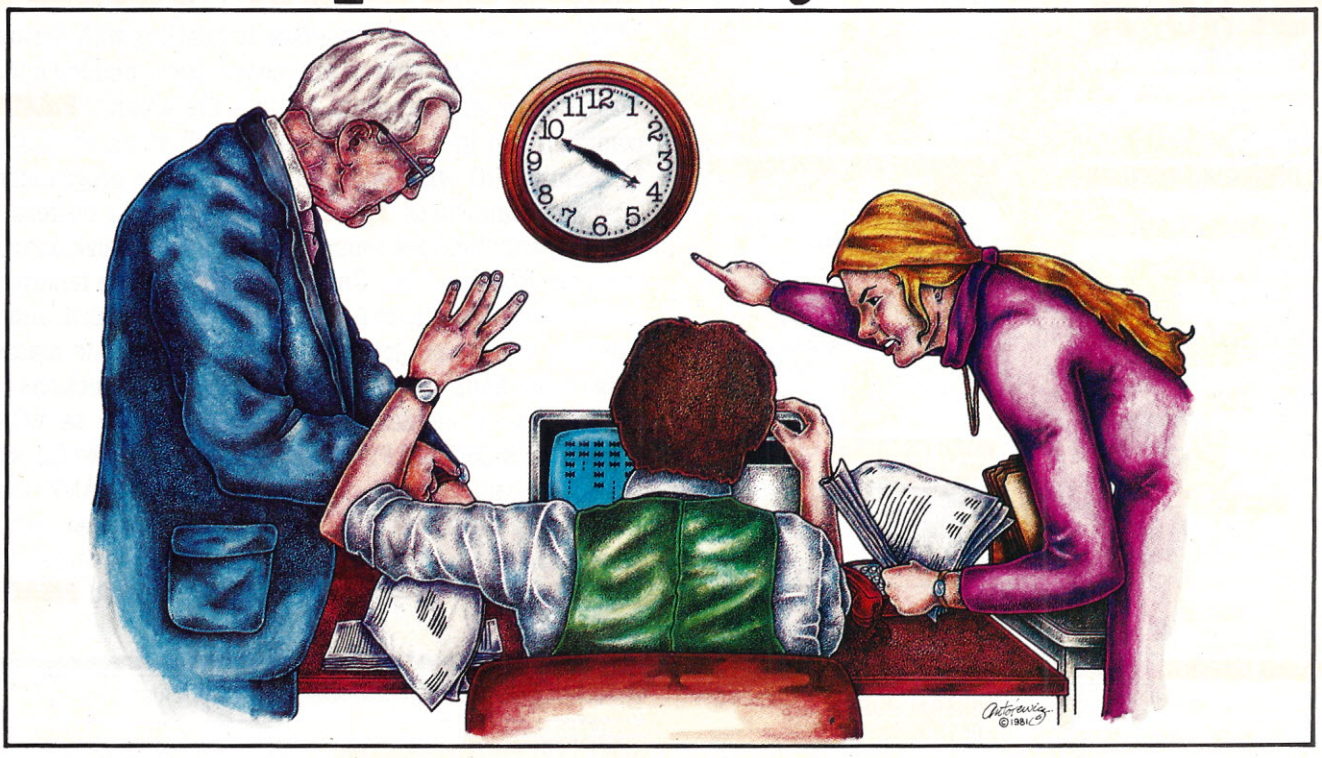
So after years of marching one word after another across a typewriter roller, I now watch the cursor drop the letters as it goes. There's just one problem left—but I think I have the answer for that.

The powerhouse electronic Hermes typewriter has gone to my wife's office up on the second floor, and her Report Electric was passed on to our college junior. The Olympia electric portable went to Washington with my college freshman. But those machines wouldn't have been any use anyway, if the problem I fear comes along.

Power failure.

At my right knee, in the well of the desk, sits my ancient Royal Standard, a high-mileage 1948 model. It is carefully covered. It has a new ribbon. ■

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FORMS 2 FOR CIS COBOL
MAGSAM III
MAGSAM IV
MDBS.DRS
MDBS.RTL
M/SORT FOR COBOL-80
PEARL
QSORT
STRING BIT
STRING/80
SUPER-SORT
ULTRASORT II

WORD PROCESSING SYSTEMS AND AIDS

MAGIC WAND
LETTERIGHT
MICROSPELL
SPELLGUARD
TEX
TEXTWRITER III
WORD-STAR
WORDINDEX

DATA MANAGEMENT PACKAGES

CONDOR
HDBS
MDBS
MDBS.QRS
WHATSIT?

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SELECTOR III-C2
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ACCOUNTS PAYABLE (SSG)
ACCOUNTS RECEIVABLE (PTREE)
ACCOUNTS RECEIVABLE (SSG)
GENERAL LEDGER II (CPAIDS)
GENERAL LEDGER (PTREE)
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PASCAL USER MANUAL AND REPORT
PAYROLL WITH COST ACCOUNTING-CBASIC
STRUCTURED MICROPROCESSOR PROGRAMMING
USING CP/M—A SELF-TEACHING GUIDE

ACCESSORIES

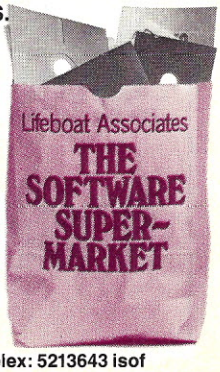
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Ordering Information

COMPUTERS SUPPORTED WITH MEDIA FORMAT ORDERING CODES.

ADDS Multivision . . . . . RT
AVL Eagle . . . . . RB
Altair 8800 . . . . . B1
Altos A1
Apple CP/M 13 Sector . . . . . RG
Apple CP/M 16 Sector . . . . . RR
BASF System 7100 . . . . . RD
Blackhawk Micropolis Mod II Q2
Blackhawk Single Density . . Q3
CDS Versatile 3B Q1
CDS Versatile 4 . . . . . Q2
COMPAL-80 . . . . . Q2
CSSN Backup T1
Cromemco System 3 . . . . . A1
Cromemco Z2D R6
Delta Systems A1
Digi-Log Microterm II . . . . . RD
Digital Microsystems A1
Durango F-85 . . . . . RL
Dynabyte DB8/2 . . . . . R1
Dynabyte DB8/4 . . . . . A1
Exidy Sorcerer + Lifeboat CP/M Q2
Heath H8+H17/H27 disk . . . P4
Heath H89+Lifeboat CP/M P4
Heath H89 + Magnolia CP/M P7
Helios II B2
ICOM 2411 Micro Floppy . . . R3
ICOM 3712 . . . . . A1
ICOM 3812 . . . . . A1
ICOM 4511 5440 Cartridge CP/M 1.4 . . . . . D1
ICOM 4511 5440 Cartridge CP/M 2.2 . . . . . D2
IMS 5000 . . . . . RA
IMS 8000 . . . . . A1
IMSAI VDP-40 . . . . . R4
IMSAI VDP-42 . . . . . R4
IMSAI VDP-44 . . . . . R5
IMSAI VDP-80 . . . . . A1
ISC Intecolor 8063/8360/8963 . . . . . A1
Intertec Superbrain DOS 0.1 R7
Intertec Superbrain DOS 0.5 RJ
Intertec Superbrain DOS 3.x RK
Intertec Superbrain QD . . . . RS
Kontron PSI-80 . . . . . RF
MITS 3200-3202 . . . . . B1
MSD 5.25 in. . . . . RG
Meca Delta-1 5.25 in P6
Micromation A1
Micropolis Mod I Q1
Micropolis Mod II Q2
Morrow Discus A1
Mostek A1
North Star Single Density . . P1
North Star Double Density . . P2
North Star Quad Density . . . P3
Nylac Micropolis Mod II Q2
Nylac Single Density Q3
Ohio Scientific C3 . . . . . A3
Onyx C8001 . . . . . T2
Pertec PCC 2000 . . . . . A1
Processor Technology Helios II B2
Quay 500 . . . . . R0
Quay 520 . . . . . RP
RAIR Single Density R9
RAIR Double Density . . . . . RE
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Sanyo 7000 5.25 in . . . . . RQ
Spacebyte A1
TEI 5.25 in R3
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Vista V200 5.25 in. Double Dens P6
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Computerized typesetting promises to revolutionize the publishing industry.

Beyond Gutenberg

By Bob Woodbury

Hello, Chief? Jimmy here. Have I got a scoop! You know the Metropol Hotel? It's burning down... yep, fire trucks all over the place.... What do you mean, have I got the story? Of course I have the story.... All set? Here it is: 'The wail of sirens pierced the night as the Metropol Hotel, pride of Metropolis, burned out of control....' "

Forty years later—"Hello, Chief? Jimmy here. Got a story! You know the New Metropol Hotel? It's burning down... yep, again.... What do you think I am? Of course I got the story .... Let me put the phone on my terminal. Here goes.... Got it? Talk to you later, Chief."

Times have changed. A reporter used to type a story on a typewriter and read it over the phone to someone who typed it on a typewriter. The story then had to go to the editor, who marked it up and sent it over to the typesetter, who again typed it into the typesetting machine.

Nowadays, that's passé. With a portable terminal, a reporter can save the story and transmit it over the same phone he calls the boss on. The editor looks at the story on his video terminal, makes whatever changes are needed and transmits the story to the typesetting department. From start to finish, the story is in electronic form, eliminating the costly repetition and errors of the old method.

But this is something only the big dailies can afford. If you are preparing your club newsletter or company advertising, you'll just have to do it the old way. If you're a lawyer with dozens of legal documents which must look very professional, well, you'll just have to hire a typist to prepare the copy. Then you'll have to send it to the people at the typesetting shop, who will charge you plenty to type all this copy into their typesetter. That's life! Right?

Wrong!

Anyone who has access to a terminal connected directly to a computer or to a timesharing service by phone can use technology available right

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```
`IN`EMThis is a demonstration of the use of typesetting codes within a body
of text. Every code provided for by the translation table is demonstrated
in this example, so this demonstration copy is chock-full of typesetting
codes. Normally, you would use only a few codes in a body of text.`p
The first thing you should note is that the text you see has been enlarged or
reduced as needed for reproduction in this magazine. Consequently, the type
sizes selected in these examples will probably appear smaller than they did
on the original copy.`p
Second, you should begin every file with the initialize code. This sets up
the Editwriter to these initial values: line length equal to 45 picas, line
space equal to 12 points, type size equal to 12 points, and font 1 selected.
Let's change those values to something else:`s
`SZ14`LS145`FT3`LL4000`EMNow we have selected a larger size type (14 points),
a greater line spacing (14.5 points), a shorter line length (40 picas and
00 points), and font 3 has been selected. These values may be changed at any
point in the text file. Let's change the size back to 12 points and the font
back to 1. Also, we will change the line spacing to 12.5 points, and the
line length back to 45 picas.`s
`SZ12`FT1`LS125`LL4500`EMLet's look at the characters available to us. Most of
the ASCII characters are here:`s
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`QL`r
1 2 3 4 5 6 7 8 9 0 - = ! @ # $ % & * ( ) _ + [ ] { ; : { } , . / ?`QL`r
Some of the ASCII characters are not on the 501 filmstrip layout. These are
the backslash, the carat, the tilde, the accent grave, the greater-than
sign, and the less-than sign. If we send a text file with these characters,
they will show up in this manner:`s
\ ^ ~ ` > <`p
The apostrophe and the quotation mark are treated in a special way by the
translation table. The Editwriter has not only the seconds symbol and the
minutes symbol, it also has open quotes and close quotes. Here is an
example:`s
`!`EM`"`EM `'`EM!`EM `"`EM"`p
This may look complicated, but you will find it quite natural. In short, an
apostrophe is translated into a single close quote unless it follows a
space, in which case it becomes a single open quote. This takes care of
contractions such as: it's, didn't, and couldn't, but allows us to set off
a phrase in 'single quotes.' Double quotes work the same way and we can set
off a phrase in "double quotes." If we want a seconds symbol or a minutes
symbol, they may also be had: `' `".`p
In addition to the ASCII character set, we have several special characters.`s
`12 `13 `14 `23 `34 `81 `82 `83 `84 `85 `86 `87 `88 `89 `90 `91 `92 `93 `94
`95 `96 `97 `98 `99 `+ `- `/ `*`p
It's time to talk about justification`83the adjustment of
characters in a line so the lines are even at the left, or at the right, or
both left and right. It is accomplished automatically by the Editwriter, or
it can be controlled by you. When the initialize code was used at the
start of the text file, the Editwriter was set up for full justification,
both left and right. Individual lines may be left or right justified, or
centered, by using quadding codes.`s
`r
This line is left justified.`QL`r
This line is centered.`QC`r
This line is right justified.`QR`r
I goofed on this line.`r
`r
```

Sample run. This is part of the demonstration text as it appears prior to being transmitted to the Editwriter. Most text files would contain far fewer typesetting codes.

now to produce finished typeset copy. Word processors, if they are equipped with a communications option, are especially suitable for this kind of work, but almost any terminal will do. For example, look at the way my club does it.

The Northwest Computer Society is an association of computer hobbyists and professionals. We produce a monthly newsletter called *The Northwest Computer News*, located in Seattle, WA. For a long time we used Nordata timesharing service to store the text for our newsletter. Those members with terminals keyboard their articles into a file on the downtown computer. The editor looked at the articles on a terminal and made needed changes. When all the articles were ready, they were turned into camera-ready copy. One way to do this was to use a program to format the articles (make all the lines come out the right length) and send the articles to a terminal with a letter-quality printer. The copy was cut and pasted up and sent to a commercial print shop. But it wasn't typeset copy; it looked like it was done at home on a typewriter.

That's the way we used to do it. Now we transmit the articles over the phone to a typesetting machine equipped with a communications option. The typeset copy is pasted up and sent to a commercial print shop. The result is a professional-looking publication.

What Is Typesetting?

Typesetting is what makes the type in this magazine look good. The letters are much sharper and more finely formed than would be possible with a typewriter. Each letter occupies a different amount of space on the line, depending on how much space is needed to make it look right. Hundreds of different typestyles are available, in bold and italic styles as well as roman (roman is the regular form of a typestyle).

Do you want to change typestyles in the middle of a line? No problem—typesetting machines do that sort of thing all the time. How about changing the size of the characters? That's easy, too. Typesetting machines have a wide selection of sizes usually ranging from a small fraction of an inch in height to an inch or more.

For professional-looking advertisements, invitations, business cards, instruction books, magazines and newsletters, typesetting is a must.

Phototypesetting is the most widely used typesetting method today. Several different manufacturers make the equipment so there is a wide variety of designs. *The Northwest Computer News* is typeset on a Compugraphic Editwriter 7500 because that machine can be equipped with an Intelligent Communications Interface. This lets us transmit our text files from the timesharing system we use to the Editwriter 7500.

Table 1. Typesetting codes and their functions.

Function Codes

`IN	The "Initialize" code sets up the Editwriter to predetermined default parameters, clearing any previous parameters in the process. It should be used at the beginning of every text file.
`SZ	The "Set Size" code selects the type size. It may be used anywhere in the text file to change the size to a new value. It must be immediately followed by a two digit number indicating the actual point size desired. To find out what point sizes are available, ask the people at your type shop.
`LS	The "Set Line Space" code selects the vertical spacing between lines. It may be used anywhere in the text file to change the line spacing to a new value. It must be immediately followed by a three digit number indicating the spacing in points and half points. The first two digits indicate points; the third digit indicates half points and must be either a zero or a five. For example, 120 means 12.0 points and 125 means 12.5 points.
`FT	The "Select Font" code specifies the typestyle you wish to use. It must be immediately followed by a single digit number from one to eight. Check with your typeshop to find out which typestyles are available and in what combinations.
`LL	The "Set Line Length" code specifies the horizontal length of the lines. It may be used anywhere in the text file to change the line length. It must be immediately followed by four digits; the first two digits indicate the number of picas and the second two digits indicate the number of points. For example, 1905 means 19 picas and 5 points. To find out what the maximum line length may be, check with your typeshop.
`r	(accent grave—r—return) The "Hard Return" causes the "carriage" to return to the left margin and the paper to feed one line space. In your text file, carriage returns will be converted by the translation table into spaces. This is so the Editwriter can justify the lines by putting in its own soft returns. If you want to specify a return in a particular place, use a hard return.
`QL	The "Quad Left" code is used to keep the Editwriter from fully justifying a line. It will cause the line to be left justified leaving excess white space on the right. It must be immediately followed by a hard return code, a tab return code, a call tab code, or an end line code. It may not be used when in the justify left, justify right, or justify center modes.
`QR	The "Quad Right" code is used to right justify a line leaving the excess white space to the left. It must be immediately followed by a hard return code, a tab return code, a call tab code, or an end line code. It may not be used when in the justify left, justify right, or justify center modes.
`QC	The "Quad Center" code is used to center a line leaving the excess white space evenly to the left and the right. It must be immediately followed by a hard return code, a tab return code, a call tab code, or an end line code. It may not be used when in the justify left, justify right, or justify center modes.
`JL	The "Justify Left" code causes all text following it to be justified left, as with a typewriter. Do not use quadding codes, paragraph codes, or end section codes when in the justify left mode.
`JR	The "Justify Right" code causes all text following it to be justified right. Do not use quadding codes, paragraph codes, or end section codes when in the justify right mode.
`JC	The "Justify Center" code causes all text following it to be centered leaving excess white space evenly to the left and the right. Do not use quadding codes, paragraph codes, or end section codes when in the justify center mode.
`JF	The "Justify Full" code returns you to the fully justified mode after having used the justify left, right, or center codes. In the justify full mode, you may again use quadding codes, paragraph codes, and end section codes. Otherwise the text will be fully justified both left and right.
`EM	The "EM space" is like a blank character. It is a fixed amount of white space and may be used to indent paragraphs. A spacebar is inadequate for indentations because the Editwriter will cause the amount of white space of a spacebar to vary when it justifies a line. The EM space is approximately as wide as the type size you are using. If you are using 12 point type, the EM will be approximately 12 points wide. Its exact width is determined by the typestyle in use.
`EN	The "EN space" is like an EM, only narrower. It is approximately two-thirds as wide as an EM.
`TH	The "THIN space" is also like an EM, only narrower. It is approximately one-third as wide as an EM.
`s	(accent grave—s—return) The "End Section" code is used to end sections of text. It is simply a short way of saying, "Quad Left—Hard Return."
`p	(accent grave—p—return) The "Paragraph" code is used between paragraphs. It is simply a short way of saying, "Quad Left—Hard Return—EM Space."
`e	(accent grave—e—return) The "End Line" code is like a hard return except no paper feed takes place. Do not use the end line code when in the tab mode. You are in the tab mode from the time you use a call tab code to the time you use a quit tabs code.
`MS	The "Minus Line Space" code causes the Editwriter to back the paper up one line space without moving the "carriage."
`PS	The "Plus Line Space" code causes the Editwriter to advance the paper one line space without moving the "carriage."
`MP	The "Minus Point Space" code causes the Editwriter to back the paper up one point for each code used without moving the "carriage."
`PP	The "Plus Point Space" code causes the Editwriter to advance the paper one point for each code used without moving the "carriage."
`IS	The "Insert Space" code is used to insert equal amounts of white space at various places in a line. It may be used several places in one line. The line must be ended with a hard return, a tab return, a call tab, or an end line code. Quadding codes must not be used.
`IC	The "Insert Character" code is used to repeat a character the length of a line. It is immediately followed by the character to be repeated. It operates only upon a single character. The line must be ended with a hard return, a tab return, a call tab, or an end line code. Quadding codes must not be used.
`HY	The "Auto-Hyphen" code is used to turn automatic hyphenation off and on. The Editwriter will automatically hyphenate a word when convenient to end a line unless we tell it otherwise. The first time the auto-hyphen code is used in a text file, the auto-hyphenation is turned off. The second time, it is turned back on. The third time, it is turned off. And so on.
`TS	The "Tab Set" code is used to define a tab. It must be followed by a nine digit number and a letter. Digit one is the reference number of the tab, 1-9. Digits two through five specify the starting point on the line of the tab in picas and points (digits two and three are the picas, and digits four and five are the points). Digits six through nine specify the length of the tab in picas and points. The letter specifies how the copy should be justified within the tab. It should be a J, L, R, or C.
`CT	The "Call Tab" code is used to call a tab into use which has been defined by the tab set code. It must be immediately followed by the reference number of the tab, 1-9. A new call tab code will take you out of a particular tab and into the new tab. A hard return (and a soft return) returns the "carriage" to the left margin of the tab, not the left margin of the paper.

The Editwriter is one of the most popular phototypesetters and can be found in typeshops in any good-sized city. More and more of the typeshops with Editwriters are installing the Intelligent Communications Interface. These are the shops you should contact when you want to typeset material you have already stored in your word processor or computer.

The Editwriter 7500 may have as many as eight typefaces in the machine at one time. The characters are on a filmstrip which looks like a long narrow photographic negative. The filmstrip is mounted on a rotating drum and an electronic flash lamp is flashed at the proper time to project one of these characters onto photographic paper.

The Editwriter is also equipped with a secretarial keyboard, four auxiliary keypads, an eight-inch hard-sectored floppy-disk drive and a CRT monitor, all controlled by a microprocessor. The machine functions as a word processor with the ability to do screen editing of copy and manipulation of disk files. When the copy has been edited and stored on disk, it may be set, at which time the computer directs the flashing of the electronic flash and the movement of a mirror to position the characters on the paper. Once the copy is set, the photographic paper is removed from the machine and developed in a special processor. Now the copy is ready to be pasted up and sent to the print shop.

`t (accent grave—t—return) The "Tab Return" code takes you out of a tab, returns the "carriage" to the left margin of the paper, and feeds the paper one line space.

`q (accent grave—q—return) The "Quit Tabs" code takes you out of the tab mode. You are in the tab mode from the time you use a call tab code to the time you use a quit tabs code. This code does not feed the paper, but it does move the "carriage" to the left margin of the paper.

Special Character Codes

`12	One-Half (½)
`13	One-Third (⅓)
`14	One-Fourth (¼)
`23	Two-Thirds (⅔)
`34	Three-Fourths (¾)
`81	EN Leader (this looks like a period but is used when you want several dots in a row)
`82	EN Dash (longer than a hyphen but shorter than an EM dash)
`83	EM Dash (longest dash of all)
`84	Degree Sign (°)
`85	Section Mark (§)
`86	Double Dagger (‡)
`87	Dagger (†)
`88	Right Pointer (►)
`89	Left Pointer (◄)
`90	Paragraph Mark (¶)
`91	Large Dot (●)
`92	Small Dot (•)
`93	Solid Box (■)
`94	Open Box (□)
`95	Copyright (©)
`96	Registered (®)
`97	Check Mark (✓)
`98	Open Star (☆)
`99	Solid Star (★)
`+	Plus or Minus (±)
`-	Minus Sign (−)
`/	Divide Sign (÷)
`*	Times Sign (×)
`'	Seconds (′)
`"	Minutes (″)

ASCII Characters

With six exceptions, the characters of the ASCII set are available on the 501 layout. There is no need to use a code to obtain ASCII characters. They are handled directly by the translation table.

The six exceptions are the backslash, the carat, the tilde, the greater-than sign, the less-than sign, and the accent grave. When these characters are sent over as part of the text file, they will be translated into the following character strings:
[REVSLASH], [CARAT], [TILDE], [GRTRTHAN], [LESSTHAN], [GRAVE].

The accent grave is translated in this manner only if it is not used in conjunction with other characters as provided in the translation table.

An ASCII apostrophe will be translated into a single close quote unless it follows a spacebar or a return in which case it will be translated into a single open quote, or unless it follows an accent grave in which case it will be translated into a seconds symbol.

An ASCII quotation mark will be translated into a double close quote unless it follows a spacebar or a return in which case it will be translated into a double open quote, or unless it follows an accent grave in which case it will be translated into a minutes symbol.

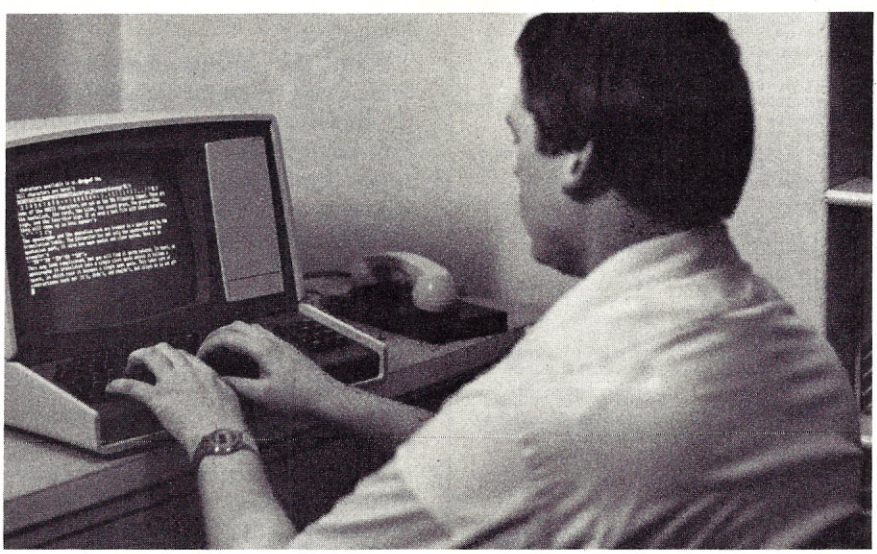


Photo 1. Copy to be typeset is first entered into a text file on a computer—in this case a timesharing system. Typesetting codes can be included in the text file, or the typesetter/operator may insert them later.

The ICI

The Intelligent Communications Interface (ICI) is a device which is installed inside the Editwriter. It provides one RS-232C port and uses either the asynchronous TTY (Teletype) protocol using ASCII (American Standard Code for Information Interchange) or the bisynchronous protocol using EBCDIC (Extended Binary Coded Decimal Interchange Code). It will operate at speeds from 50 to 19,200 bits-per-second in the asynchronous mode and at 1200, 2400 or 4800 bits-per-second in the bisynchronous mode.

Almost all home computer terminals and many word processors use the asynchronous protocol, so that is what will be discussed for the rest of this article. However, many word processors, especially those made by IBM, use the bisynchronous protocol. The ICI works very well bisynchronously, but be sure the typeshop you are dealing with has a modem that can handle the higher speed, and be sure their modem is compatible with your modem.

What You Will Need

Any microcomputer with the ability to send disk files to a modem will do the job. It should have a word processing software package of some sort to make it easy to create text files and to edit them. It must have the

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software to enable it to send disk files. Beware of terminal programs. These programs often let you send only from the keyboard, not from the disk. And beware of printer ports which will not support a modem.

A word-processing system with the ability to communicate is ideally suited to this application. Word processors usually have special convenience features such as tabs which can be translated into Editwriter codes.

If you only have a terminal, that's all right. Maybe you have access to your company's computer, or maybe you have an account on a timesharing service. If you can create, edit and retrieve text files from these big computers, you're in business.

```
/=//==//
/V603132=04/          ONE-HALF
/V603133=33/          ONE-THIRD
/V603134=00/          ONE-FOURTH
/V603233=73/          TWO-THIRDS
/V603334=40/          THREE-FOURTHS
/V603831=6F/          EN LEADER
/V603832=51/          EN DASH
/V603833=53/          EM DASH
/V603834=6D/          DEGREE
/V603835=4D/          SECTION MARK
/V603836=4F/          DOUBLE DAGGER
/V603837=6B/          DAGGER
/V603838=860D/        RIGHT POINTER
/V603839=860F/        LEFT POINTER
/V603930=8621/        PARAGRAPH MARK
/V603931=8431/        LARGE DOT
/V603932=840F/        SMALL DOT
/V603933=862B/        SOLID BOX
/V603934=842B/        OPEN BOX
/V603935=8421/        COPYRIGHT
/V603936=8415/        REGISTERED
/V603937=8427/        CHECK MARK
/V603938=863B/        OPEN STAR
/V603939=843B/        SOLID STAR
/V602B=67/            PLUS OR MINUS
/V602D=7B/            MINUS
/V602F=43/            DIVIDE
/V602A=55/            TIMES
/V23=8403/            NUMBER SIGN
/V25=840D/            PERCENT SIGN
/V7B=8627/            LEFT BRACE
/V7D=8603/            RIGHT BRACE
/V7C=8615/            VERTICAL BAR
/V5F=842D/            BASE LINE RULE
/V27=10/              SINGLE CLOSE QUOTE
/V2027=0850/          SINGLE OPEN QUOTE
/H
'=0850/               SINGLE OPEN QUOTE
/V6027=8631/          SECONDS SYMBOL
/V6022=862D/          MINUTES SYMBOL
/V22=1010/            DOUBLE CLOSE QUOTE
/V2022=085050/        DOUBLE OPEN QUOTE
/H
"=085050/             DOUBLE OPEN QUOTE
/R3C=[LESSTHAN]/      [LESSTHAN]
/R3E=[GRTRTHAN]/      [GRTRTHAN]
/R5C=[REVSLASH]/      [REVSLASH]
/R5E=[CARAT]/         [CARAT]
/R60=[GRAVE]/         [GRAVE]
/R7E=[TILDE]/         [TILDE]
/V605453=FA/          TAB SET
/V604354=8A/          CALL TAB
/V604A4C=8464/        JUSTIFY LEFT
/V604A52=8454/        JUSTIFY RIGHT
/V604A43=845C/        JUSTIFY CENTER
/V604A46=8456/        JUSTIFY FULL
/V60710D=8429/        QUIT TABS
/V60700D=BC290B/      PARAGRAPH
/V60720D=29/          HARD RETURN
/V60730D=BC29/        END SECTION
/V60740D=F8/          TAB RETURN
/V60650D=1B/          END LINE
/V604953=17/          INSERT SPACE
/V604943=49/          INSERT CHARACTER
/V605114C=BC/         QUAD LEFT
/V605143=3D/          QUAD CENTER
/V605152=1F/          QUAD RIGHT
/V60454D=0B/          EM SPACE
/V60454E=1D/          EN SPACE
/V605448=01/          THIN SPACE
/V604859=96/          AUTO HYPHEN
/V604C4C=D0/          SET LINE LENGTH
/V604654=D2/          SET FONT
/V604C53=D4/          SET LINE SPACE
/V60535A=D6/          SET SIZE
/V604D53=C8/          MINUS LINE SPACE
/V605053=CE/          PLUS LINE SPACE
/V604D50=CA/          MINUS POINT SPACE
/V605050=CC/          PLUS POINT SPACE
/V60494E=8CDE3B273B272D3B15212D2D0829/
                      INITIALIZE
/V605A=E4DE/
/I
`Z
```

Listing 1. The translation table must be accurately entered into a disk file. It is sent to the Editwriter prior to the text files and serves to translate the typesetting codes in the text files into Editwriter codes.

A Lesson in Typesetting

Before I explain exactly how to create text files and send them to the Editwriter, a lesson in the basics of typesetting is in order. A typesetting machine can do marvelous things with your copy. It can justify the lines so they all come out the same length. Both the left margin and the right margin are even. It does this by ending the lines in a convenient place and stretching the spaces between the words and the letters. It can automatically hyphenate words, too.

You can direct it to left justify your copy. This makes the left margin even but leaves the right margin ragged, which is how a typewriter does it. Or you can direct it to right justify the copy, making the right margin even and leaving the left margin ragged. You can even center the copy, leaving both margins ragged but with an equal amount of white space at each end of the line.

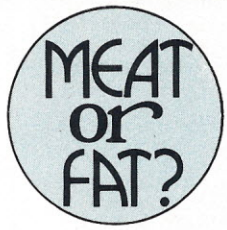
Tabs are available, too. All you have to do is specify the starting point on the line and the length of the tab. Copy within a tab can also be fully justified, left justified, right justified or centered.

With the insert character command, you can repeat a single character the length of a line using only a few keystrokes. And with the insert space command, you can insert equal amounts of white space at various places within a line.

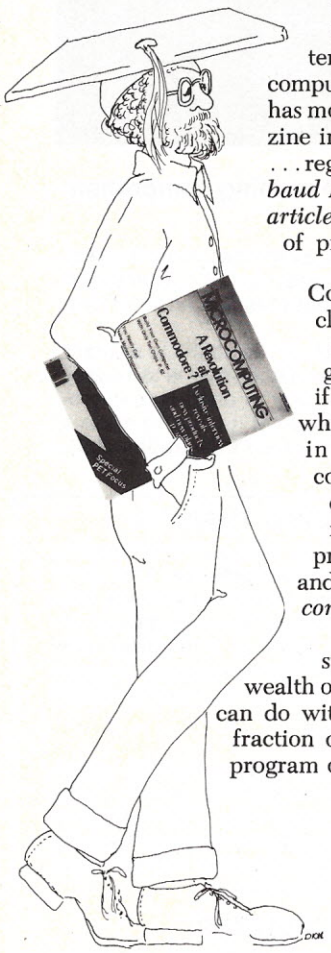
Using the font select command, you can select a different typeface, and other commands allow you to change the spacing between lines, the length of the lines, and the size of the type at any time. In the typesetting world, size and length are measured in picas and points. A point is approximately equal to 1/72 of an inch, and a pica is 12 points. That makes six picas to the inch. The size of the type and the spacing between lines is specified in points, while the length of a line is given in picas and points.

(Continued on page 100.)

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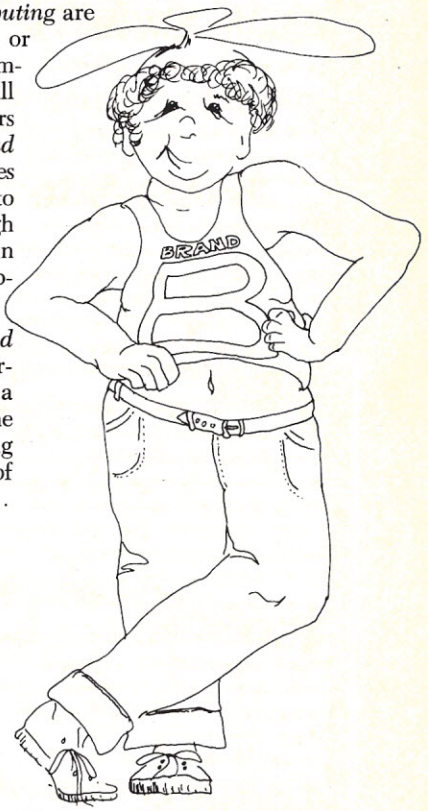


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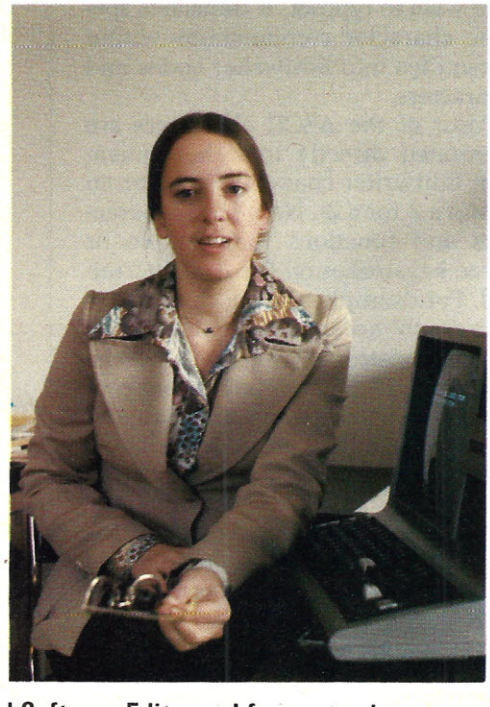
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(From page 96.)

Finally, more characters are found in a typesetter than on a word processor or computer terminal. There's a copyright symbol, a dagger, a double-dagger, various fractions and many other characters. If the characters you want aren't available on the filmstrip you are using, other filmstrips are available. For example, the Greek & Math filmstrip has the entire Greek alphabet and all the math symbols you can think of.

In this article, I assume the use of the 501 filmstrip layout. This is one of the most common layouts, and virtually all typeshops with Editwriters have these filmstrips. If you want to use another layout, that's no problem. Just find out from your typeshop which characters on the new layout match in position the characters on the 501 layout.

The Translation Table

With all the functions and special characters available on a typesetter, you can imagine the number of keys on the keyboard. How then do you access all those keys if all you have is an ASCII terminal with its limited character set? The answer lies in the translation table (Listing 1). This table is transmitted as a file to the Editwriter immediately prior to the files you wish to typeset. It translates specific character combinations within those files into Editwriter codes and characters.

Most of the ASCII characters are translated directly into the equivalent Editwriter character (an I for an I, and a 2 for a 2). Non-ASCII characters and functions require two or three keystrokes on the ASCII terminal. For example, the check mark requires an accent grave (the backwards apostrophe) followed by the two digits 97. All the conversions provided for by the translation table in Listing 1 are defined in Table 1 and demonstrated in the Sample run and Fig. 1.

The translation table in Listing 1 is for a terminal, computer or word processor which communicates in ASCII. Those which communicate in EBCDIC should use a different table. Check with your typeshop for information on EBCDIC tables.

When typing the translation table and the text into files, you will doubtless make some errors. Do not use the backspace key or a control-H to back up and correct these errors. Instead, use the delete key. Backspaces and control-H's are usually stored as characters in your file. They will foul up the translation process. The delete code (rubout to some) actually removes the offending character from memory.

The accent grave was chosen as a delimiter for the special characters and functions because it is not commonly used in text. If your terminal or word processor does not have this character, the translation table can be modified to use another character as the delimiter. A semicolon works



Photo 2. After the text file has been transmitted to the Editwriter, the resulting typeset copy is pasted up. The product is camera-ready.

Fig. 1. This is the demonstration text in typeset form. It is the result of transmitting the demonstration text from a computer disk file to the Editwriter.

This is a demonstration of the use of typesetting codes within a body of text. Every code provided for by the translation table is demonstrated in this example, so this demonstration copy is chock-full of typesetting codes. Normally, you would use only a few codes in a body of text.

The first thing you should note is that the text you see has been enlarged or reduced as needed for reproduction in this magazine. Consequently, the type sizes selected in these examples will probably appear smaller than they did on the original copy.

Second, you should begin every file with the initialize code. This sets up the Editwriter to these initial values: line length equal to 45 picas, line space equal to 12 points, type size equal to 12 points, and font 1 selected. Let's change those values to something else:

Now we have selected a larger size type (14 points), a greater line spacing (14.5 points), a shorter line length (40 picas and 00 points), and font 3 has been selected. These values may be changed at any point in the text file. Let's change the size back to 12 points and the font back to 1. Also, we will change the line spacing to 12.5 points, and the line length back to 45 picas.

Let's look at the characters available to us. Most of the ASCII characters are here:
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
1 2 3 4 5 6 7 8 9 0 - = ! @ # $ % & * ( ) _ + [ ] | ; : { } , . / ?
Some of the ASCII characters are not on the 501 filmstrip layout. These are the backslash, the carat, the tilde, the accent grave, the greater-than sign, and the less-than sign. If we send a text file with these characters, they will show up in this manner:
[REVSLASH] [CARAT] [TILDE] [GRAVE] [GRTRTHAN] [LESSTHAN]

The apostrophe and the quotation mark are treated in a special way by the translation table. The Editwriter has not only the seconds symbol and the minutes symbol, it also has open quotes and close quotes. Here is an example:
' " ' ' " "

This may look complicated, but you will find it quite natural. In short, an apostrophe is translated into a single close quote unless it follows a space, in which case it becomes a single open quote. This takes care of contractions such as: it's, didn't, and couldn't, but allows us to set off a phrase in 'single quotes.' Double quotes work the same way and we can set off a phrase in "double quotes." If we want a seconds symbol or a minutes symbol, they may also be had: ' ".

In addition to the ASCII character set, we have several special characters.
½ ⅓ ¼ ⅔ ¾ . - — ° § ‡ † ► ◄ ¶ ● • ■ □ © ® ✓ ☆ ★ ± − ÷ ×

It's time to talk about justification—the adjustment of characters in a line so the lines are even at the left, or at the right, or both left and right. It is accomplished automatically by the Editwriter, or it can be controlled by you. When the initialize code was used at the start of the text file, the Editwriter was set up for full justification, both left and right. Individual lines may be left or right justified, or centered, by using quadding codes.

This line is left justified.

This line is centered.

This line is right justified.

I goofed on this line.

Unless you tell it otherwise, the Editwriter will justify your lines both left and right. Let's make it justify all text left.

The "justify left" code causes all text to be "neat left, ragged right." This is how a typewriter would do it. It's useful with business letters, reports, resumes, and poetry. Do not use quadding codes when

well because it is always followed by a space in text. The presence of some other character or characters following it would clearly indicate a special character or code.

To modify the translation table to use a semicolon instead of an accent grave, substitute /V3B wherever /V60 appears in the table. The translation table can be tailored to your specific terminal or word processor. Your typeshop should have the documentation you need to do this. Compugraphic Corporation has prepared dozens of translation tables customized for the popular word-processing systems on the market. Your typeshop will probably be able to obtain a custom translation table for you if you are using a word processor or large mainframe computer. With a table customized to your particular word processor, you will be able to take advantage of the special features it provides.

in the left justified mode. Do not use the "paragraph" or "end section" codes. Use only a hard return at the end of each section.

The "justify center" code causes all text to be centered. It is useful in advertising and in many other unusual applications. Do not use quadding codes while in the center justified mode. Do not use the "paragraph" or "end section" codes. Use only a hard return at the end of each section.

The "justify right" code causes all text to be "neat right, ragged left." This is the opposite of the way a typewriter works. It's useful in advertising and other special applications. Again, do not use quadding codes while in the right justified mode. Do not use the "paragraph" or "end section" codes. Use only a hard return at the end of each section.

The "justify full" code causes all text to be fully justified. It puts us back where we started. Now we must use quadding codes if we wish to left, right, or center justify a particular line. Otherwise, the line will be fully justified.

EM spaces, EN spaces, and THIN spaces are used for indenting paragraphs and for other applications where a fixed space is needed. In typesetting, the spacebar must not be used for indenting because the typesetter will cause the spacing to vary when it justifies the line. The indent would vary from one paragraph to another. It is customary to use an EM space to indent paragraphs, but an EN space works well, too. As a rough rule, the EM space is approximately as wide as the type size you are using, but it may vary some depending on the typestyle in use. We are using 12 points here, so the EM is approximately 12 points wide. The EN space is approximately ⅓ of an EM space, and the THIN space is approximately ⅓ of an EM space.

] [
] [
] [

By now, we have used enough hard return codes, paragraph codes, and end section codes that their function should be apparent. In order to justify the text which you are sending, the Editwriter must be allowed to determine where to put the returns. Consequently, it converts the returns in your text file into spaces. Then it puts in its own returns wherever it feels like. These are called "soft returns." Sometimes you want a return in a particular place, like at the end of each line in an address. In this case, a hard return may be used. A hard return must be obeyed by the Editwriter. If you are in the "justify full" mode, you should use a quadding code immediately in front of the hard return. A simpler way is to use the "end section" code. As you have probably figured out, this is just a quick way of saying, "quad left—hard return." Likewise, the paragraph code is just a short version of "quad left—hard return—Em space."

We haven't mentioned the "end line" code. This code is like a hard return except that no paper feed takes place. We can use it in the following manner to underscore a line of characters. The "insert character" code is explained in more detail a little further on.

This line of text is underlined.

The paper feed codes are most easily explained in typewriter terms. As we know, the return feeds the paper one line space and returns the carriage to the left margin.

The "plus line space" code advances the paper one line space without moving the carriage.

The "minus line space" code does the reverse.

The "plus point space" code advances the paper one point for each code.

The "minus point space" code does the reverse.

Use these commands with care. Do not back the paper up more than an inch.

Before we wrap up this demonstration, there are three codes which are very useful. These are the "insert space" code, the "insert character" code, and the "auto-hyphen" code.

The insert space code allows you to insert equal amounts of white space at various places in a line.

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Use only a hard return on a line which has insert space codes. Do not use quadding codes, paragraph codes, or end section codes.

The insert character code allows you to repeat a particular character the entire length of a line.

****

Name _____

Address _____

Use only a hard return on a line which has an insert character code. Do not use quadding codes, paragraph codes, or end section codes.

The auto-hyphen code is like a push-button switch. The Editwriter automatically hyphenates words unless we tell it otherwise. The first time we use the auto-hyphen code in a file, the auto-hyphenation is turned off and the Editwriter will only put in soft returns between words, rather than hyphenating words. The second time we use the code, hyphenation is turned back on. The third time, it is turned off—and so on.

Last but not least are tabs. The Editwriter can store information for nine different tabular columns at one time. Let's do a few as an example:

Item	Part Number	Price	Remarks
Jimbol	198-504	$199.99	Requires 5 frambulated gear-whizzes—not supplied.
Widget	197-503	349.99	Machined to 1/2000 inch and gold anodized.

Each tab set code is followed by nine numbers and a letter. The first number is the reference number of the tab, 1-9. The next four numbers are the starting point on the line in picas and points—the first two numbers are picas and the second two are points. The last four numbers are the the length of the tab in picas and points. The letter determines how the copy should be justified within the tab. It should be a J, C, R, or L.

Each tab is started with the call tab code followed by the reference number of the tab. You may move on to another tab by calling it. While you are in a tab, soft returns and hard returns do not return you to the left margin of the paper—only to the left margin of the tab. To get to the left margin of the paper, use a tab return code.

Do not use the end line code when in the tab mode. You are in the tab mode from the time you use a call tab code to the time you use a quit tab code.

Well, that does it. Armed with this information, you can now typeset your newsletters, brochures, what-have-you, in a professional manner.

Sending the Files

When arrangements with your typeshop have been completed and you have the translation table file and your text files ready, you will be able to phone your typeshop and say "Here it is." They will prepare their Editwriter to communicate. Once you have established a communications link with the Editwriter, all you have to do is send the translation table first and then the text files. The editwriter may function as a terminal if you are using a timesharing system which requires log-on.

What if you made a mistake in your text file? That's not a big problem. The Editwriter operator can edit your copy quickly and easily. It sure beats having to keyboard all that copy over again. And it saves a lot of time and money.

Wrapping It Up

With a word-processing system (homebrew or otherwise) you have the most powerful writing tool since the word was invented. The printing press is obviously the most powerful publishing tool. Now the two are linked more closely than ever, and it's up to you not only to save money, but to make money using this new technology. ■



Photo 3. The camera-ready sheets go to the print shop, and the final product goes to the consumer.

A single-board computer functions effectively as a dedicated controller in a life-or-death situation.

AIM for Total Control

By Dr. Michael Bazaral

The AIM 65 single-board computer can readily be used as a dedicated controller. The approach described here requires no hardware modification, and no off-board logic other than the motherboard-supported EPROM programmer and RAM (which are required only during programming). The equipment and techniques should be suitable for a wide variety of low-volume applications in production control and testing, with laboratory equipment or for personal uses.

Since the AIM 65 can be used both for program development and in the final application as a controller, no emulation is required. The essential intermediate step (and the central point of this article) is to put external RAM at the memory location of the EPROM socket that will be used in the final application. Thus, the applications programs can be written and debugged under real-time conditions in RAM, and transferred to EPROM without any assembly steps. The program in EPROM will run in any AIM 65 with the appropriate inputs and outputs, and with the appropriate jumper in place of the keyboard.

While desirable, custom-built equipment with dedicated microprocessors is usually expensive, because you need both extensive hardware design and a development system for programming. While relatively inexpensive microcomputers such as the Apple and the TRS-80 have more than adequate capabilities, they are far too bulky and fragile to be used in most dedicated controller applications. Moreover, even when equipped with disk drives, the start-up routine for these computers would discourage the intended users, most of whom will be entirely unfamiliar with computer operation. Very simple single-board computers such as the KIM and SYM are compact, but lack prewired hardware for power-on jump to EPROM, lack adequate displays and are tedious to use for developing programs.

After some research, we saw that the AIM 65 filled our needs. It has a 6502 microprocessor and a powerful 8K monitor in PROM. The monitor, together with the on-board 20-character alphanumeric display, 20-column printer and the tape cassette interface, provides the essentials for convenient program development.

The AIM 65 also has appropriate hardware to allow it to be used as a sophisticated controller. A user-dedicated 6522 VIA provides lines for up to 20 parallel bits of input or output and contains two 16-bit programmable timers. Two independent relay-driver output lines are controlled by another 6522. There are three 24-pin PROM sockets. A jump to any of these PROM locations can be obtained by a single-character keyboard command, and a power-on jump to a program in PROM can be obtained by substituting in place of the keyboard a 16-pin DIP plug having a single jumper wire.

The Application

I had developed a variety of pneumatic devices for automatic ventilation of lungs. These ventilators required an open-loop electronic controller to operate a solenoid valve, which is the key control element in the pneumatic circuits. The development of the ventilators was done using hard-wired TTL digital timing and display circuitry. The timers were adequate, but were expensive to build and difficult for most users to understand quickly.

A microprocessor-based controller seemed desirable. A microprocessor could handle the arithmetic conversions to let the user specify the operating parameters in familiar units. In this example, the hard-wired timers required "seconds per cycle" as input rather than "rate" (in breaths per minute), which is a parameter much more familiar to people who operate ventilators.

Flexibility was another advantage. The pneumatic circuits will be redesigned and improved over the next few years, and the changes in the pneumatic circuits will require major changes in controller logic. A particular hard-wired system would rapidly become obsolete, whereas a microprocessor-based system will require only reprogramming and changes in the input and output connections.

The microprocessor-based system had to meet several criteria. The electronic hardware cost for each controller could not exceed $500, including

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display and power supply. The labor to produce a finished unit had to be minimal. The controller had to be capable of a power-on jump to a program entirely in EPROM. Also important, it was necessary to have an inexpensive development system that supported convenient assembly-language programming.

In practice, creating dedicated controllers by this method is remarkably simple. The entire project, including the time required to order and to become acquainted with the equipment, took less than six months of spare time work.

Input and Output Functions

Input and output functions of the controller must be defined early in the project. The inputs for my application are front-panel switches. A two-decade BCD-encoded thumbwheel switch controls the ventilator rate (breaths per minute). An eight-position BCD-encoded rotary switch selects one of eight specific ratios of inspiration time to expiration time (I/E ratio) listed in the program. One SPST toggle switch selects between run and standby status, and another SPST switch is used to identify which of the two ventilator mechanisms is to be activated.

All connections are made via a 22/44-contact edge connector on the AIM 65 (connector J1). The appropriate pins of the user 6522 are grounded for true by the panel switches, and the resulting inputs to the board are complemented in software. Port A (eight bits) is used for the two-decade BCD switch; these lines are supplied with pull-up resistors within the 6522. The remaining five input bits are through port B. The port B lines float high but must be pulled up externally with 4.7k resistors only for the purpose of providing immunity to electrical noise.

Any of the user 6522 lines not used as inputs can be used as outputs. However, two additional output lines from a system 6522 are also available at J1. Since these two lines are supplied with on-board high current drivers (addressed by the monitor as tape recorder motor drivers), they can be used to sink current-to-drive relays without additional buffering. I used fast 5-volt DIP relays (Radio Shack 275 215) with diodes added to shunt the reverse current surge produced when the relay coils are de-energized. Memory location A800 is the byte for driver control; 1C at this location brings J1 contact W to ground, and 2C at this location brings contact V to ground potential. The off state (high) for both drivers is 0C at M = A800.

Before beginning to write the controller program, we connected the input switches and the output lines to the relays. At this point we tested the function of the input and output ports and the external hardware, along with the simple program steps required to read the data from the input ports and control the outputs. The use of the 6522 is well-illustrated in the documentation accompanying the AIM 65.

The desired displays must also be defined. The AIM 65 user's manual lists the location of monitor subroutines for display of ASCII characters, which simplifies the programming considerably. In the program I am using, four messages are placed on the display in repeating sequence. Each message is left on the display for 0.8 seconds, which is adequate time for most users to read one 20-character line. One of the timers of the user 6522 is used to determine the duration of inspiration; this information is needed to calculate the volume of gas delivered per breath, and one of the messages displayed is "INSPIRATION = X.X SEC," where X.X is the duration in seconds. The other messages list the rate and I/E ratio, and specify the ventilator being used.

The next step is to decide which of the three PROM locations will be used for the program. These sockets were primarily intended for BASIC in PROM and an assembler in PROM, and each socket is addressed through the monitor as a separate single-character keyboard command. Each socket occupies a 4K block of memory and will accept either a 2732 (4K×8) EPROM or a 5 volt 2716 (2K×8) EPROM without modification. A 2716 will be addressed as the lower 2K of the 4K block. I chose to forgo the use of the assembler and to use the location of the socket intended for the assembler (D000–D800) for the controller program.

There were two reasons for this choice. First, for relatively straightforward programs of less than 2K, the use of the assembler is probably more trouble than it is worth. The monitor alone allows mnemonic inputs, automatic computation of relative addresses, line editing and program and memory listing. Second, the BASIC in PROM was used in the generation of an extensive look-up table, and these constants were placed directly into the controller program by use of the POKE command; if one of the sockets intended for BASIC PROMs were used, I would have had to key in the look-up table by hand.

For programming, the system bus was connected to a motherboard supporting an EPROM programming board and a block-selectable static RAM board. RAM from the accessory board was switched into location D000–D800, the memory location of the (unused) assembler PROM socket. The required assembly-language program (1.5K) was written and debugged in RAM. As the program was being written, it was easily debugged at each step because it could be tested with the inputs and outputs required by the final application. After final testing, the program was copied from RAM beginning at D000 into EPROM, using the EPROM programmer supported by the motherboard.

The EPROM was then plugged into the EPROM socket at memory location D000 and the accessory RAM deselected from that location. The keyboard was disconnected from the computer board and replaced with a DIP plug having a jumper from pin 3 to pin 14, equivalent to a constant N on the keyboard. This converted the AIM to a dedicated controller. When power is turned on, the monitor scans the keyboard socket and finds N, which signals a jump to D000, where the controller program is found in EPROM.

Equipment

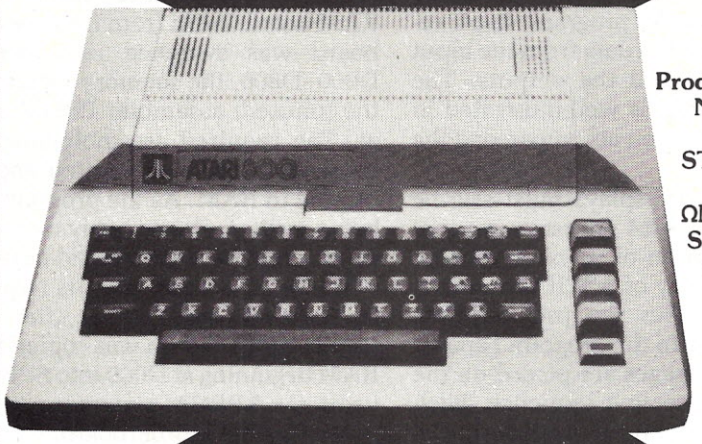
All equipment was purchased from RNB Enterprises, Phoenix, AZ. The VAK-1 motherboard ($139) is buffered, and adapts the AIM 65 to the KIM-4 bus. The AIM 65 applications connector is brought out unchanged as a separate connector on the motherboard. The VAK-5 EPROM programmer and 2716 adapter together cost $294. They are an excellent investment for those who are not primarily interested in operating system software and hardware development, since the VAK-5 on-board software in PROM works without any user programming or hardware modification. The software allows EPROM testing, programming and verification with a single command. The other commands available include a dump of EPROM to memory, which permits easy examination and modification of programs already in

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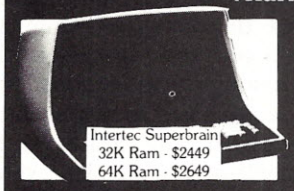
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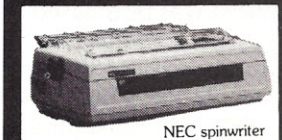
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EPROM. The VAK-EPS/AIM power supply ($149) powers everything, including the printer.

The static RAM board used was a VAK-4 ($325). This board was designed to have two separate address-selectable 8K blocks, but was modified for my application. The technique described requires placing RAM for program development at the address in which the application program EPROM will ultimately reside. Because I wanted to use the BASIC ROMs for program development (at addresses B000–BFFF and C000–CFFF), only the socket at address D000 was free on the AIM 65 board. This does not fall at an 8K boundary. Michael G. Bennett of RNB Enterprises resolved this problem by modifying the VAK-4 RAM board to a 12K board with an 8K block selectable on 8K boundaries and a 4K block on 4K boundaries. A reasonable alternative would be to use the VAK-2 8K board ($239) to provide RAM at address C000–DFFF, but only if the BASIC in RAM is removed from the AIM 65 to avoid address conflicts.

The AIM 65 with 1K of RAM costs about $375, and an additional 3K of on-board RAM costs $50. BASIC ROMs add another $99. Thus, for about $1500, I have a complete development system for dedicated controller design, and also a computer with hard copy, BASIC and 16K of contiguous RAM for scientific data processing. A development system without BASIC or on-board expansion RAM could be put together for about $1200. Electronic hardware for each subsequent dedicated controller costs about $500 and consists of an AIM 65, a 3-ampere 5-volt power supply, an Augat 16-pin DIP component carrier (for a jumper in place of the keyboard), several switches and a 2716 EPROM.

Superficially, it seems wasteful to dedicate a $400 computer to a single, relatively simple, task. Perhaps $200 per unit could be saved by a board designed specifically as a controller, using only the chips directly required in the final units. However, the costs for purchase or lease of a development system, and engineering costs, total to $20,000 or more. Thus, at least 100 identical units would be required before a savings would result. With the approach described in this article, individuals who need only one or several controllers can create their equipment with a realistic expenditure of money and effort.■

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With his new portable computer, this hardware manufacturer urges other developers to get on the move.

An Industry Challenge: The Osborne I Computer

By Adam Osborne



The current microcomputer industry leaders—Radio Shack, Apple and Commodore—have lost their way. They've turned their backs on the strategies that made the industry successful. They have redirected themselves to building more expensive computers, locked into unique proprietary software, competing with established minicomputer manufacturers. Their unrealistic perspective will trigger disaster with all the tragic ruthlessness that early success had on such companies as Imsai and Processor Technology.

I have been an observer of the industry since 1976, and have written numerous books, columns and articles on the subject. An enormous

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amount of research, combined with reader feedback, has given me an unparalleled opportunity to keep my finger on the industry's pulse. I saw as early as 1980 that the leading hardware manufacturers were making significant misjudgments. I saw that we must return to the strategies that created the microcomputer industry.

That is why I started Osborne Computer Corporation, and built the Osborne I computer.

Hardware manufacturers must concentrate on driving down the price of computer hardware. It's the only way we'll put microcomputers into more hands and keep our industry growing.

Hardware manufacturers must stay out of the software business. They must build computers that run industry-standard software. If software manufacturers can sell a few industry-standard operating systems, languages and application programs to everyone, without being beholden to one hardware manufacturer or another, then we can lower the software costs and realize the true potential of low-cost computing.

This is my mandate at Osborne Computer Corp. This is the purpose of the Osborne I.

The rest of the microcomputer industry has a few years in which they can either adopt these same policies, or they can elect to go into some other line of business.

Repeating Mistakes

There is a lesson to be learned from the minicomputer industry.

That industry represents an appalling manifestation of rigged high prices. This is particularly ironic, coming from an industry that represents itself as being at the forefront of the cost-cutting technological revolution.

The minicomputer industry consists of numerous hardware manufacturers, each of whom builds unique minicomputers, and then creates software that will not run on anyone else's computer. This combination of unique hardware design and restrictive software licensing has given manufacturers a stranglehold on their customers, forcing consumers to pay far more than necessary for minicomputer products.

Each minicomputer manufacturer reinvents their unique software, and the customer foots the bill—again, and again, and again. These manufacturers also discourage direct hardware competition, and keep peddling obsolete designs at inflated prices—once again the customer pays the tab.

A few jackals have tried to peddle replacement hardware, but only IBM CPU replacement manufacturers have succeeded, aided by the ever-present threat of antitrust litigation.

The microcomputer industry, despite its inauspicious start, was successful because it circumvented the artificial restrictions on cost-cutting imposed by minicomputer manufacturers. The early microcomputer manufacturers were lucky; they did not understand what they were doing, but they did, nevertheless, stumble on a correct strategy for success. They built hardware using industry-standard central processing units and industry-standard system buses and hardware components and connectors. Dozens of microcomputer manufacturers shared four assembly languages. If your microcomputer used the S-100 bus, numerous sources for hardware components guaranteed low hardware costs.

That is where the microcomputer industry began. That is most certainly not where industry leaders are today.

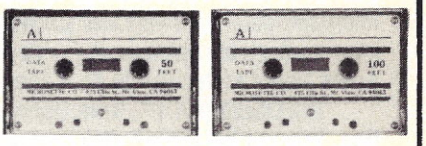
Apple and Commodore share the 6502 microprocessor, but do they have compatible software? Of course not. Even Apple's own new product, the Apple III, has limited compatibility with its predecessor, the Apple II.

Radio Shack uses the Z-80 CPU. Does that mean you can use industry-standard CP/M-based software? Yes, providing you circumvent the software strategy that Radio Shack has tried to impose on its customers. The new Radio Shack Color Computer is an inexpensive version of the TRS-80 and uses a subset of TRS-80 software, right? Wrong. It has a 6809 microprocessor that makes it completely incompatible with the rest of Radio Shack's product line.

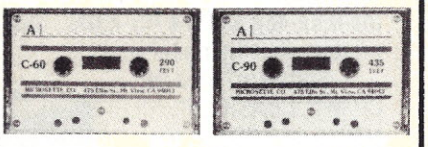
The early losers, exemplified by Imsai and Processor Technology, were superb innovators; but they were lousy businessmen, which is why they failed. Current industry leaders are managed by superb businessmen, but they are lousy innovators; therefore, they are vulnerable.

They are lousy innovators because they have rejected the novel strategies that gave birth to the microcomputer industry. I'm not sure that management ever really understood these strategies. They are now adopting the tried philosophies of the mini-

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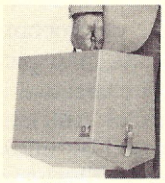
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computer marketplace and are gearing up to do battle with established minicomputer manufacturers.

With the Osborne I, I have laid down my challenge for the future. This future will see a rapid evolution of new, low-cost portable microcomputers that appeal to individuals and are used with the frequency of typewriters. Within five years I can see microcomputers such as the Osborne I selling for less than $1000, while products selling for less than $2000 will have abilities that surpass today's $10,000 microcomputers.

The Osborne I

The Osborne I microcomputer is a single integrated package, with the size and weight of a briefcase. This package includes a five-inch monitor that displays 24 rows of 50 characters. The character set includes uppercase and lowercase letters, two display intensities and underlining for all characters. Other features include two floppy-disk drives, a Z-80 CPU, 64K bytes of RAM, an IEEE-488 interface, an RS-232-C interface, a standard typewriter keyboard, modem electronics and a ten-key numeric pad. Every system comes with free, industry-standard software: CP/M, CBASIC, MBASIC, WordStar, MailMerge and SuperCalc. SuperCalc is a program of the type pioneered by Software Arts with VisiCalc.

The listed retail price for all this hardware and software is $1795. Dealers can receive 40 percent discounts.

The following hardware options are offered:

—double-density, double-sided floppy-disk drives

—a nine-inch monitor that reproduces the five-inch monitor display

—a battery pack providing three to five hours of operation away from an electric outlet

—an acoustic coupler

—a 12-inch monitor providing an 80-column display.

Many people have told me that this low price will shock the microcomputer industry. But the price is an indictment of Apple, Commodore and Radio Shack. Any one of them could have offered you this same product, probably for even less money. And they could have done so a year ago. They do not offer such a product either because they do not understand the market, or because they are afraid of undermining sales of their existing, more expensive, microcomputers.

The three industry leaders can get away with selling expensive hardware, propped up by even more expensive and unique software, as long as all mass producers of microcomputers adopt the same policies.

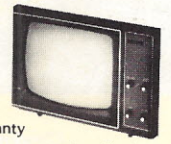
But the rules have changed.

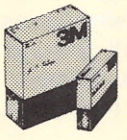
I could never have built the Osborne I computer and sold it for $1795 if I had had to underwrite the cost of developing my own operating system, language compilers and interpreters and unique application programs. But I did not have to spend money on software development; Microsoft, Digital Research, Compiler Systems and innumerable other software manufacturers have already done the job for me.

Osborne Computer Corporation (26500 Corporate Ave., Hayward, CA 94545) will continue to drive down the cost of computer hardware. Products such as the Osborne I will cost less. Products in the Osborne I price range will do more.

Within five years briefcase-sized computers will include a printer and cost less than $2000. The problem with such a configuration today is not so much parts cost as it is size. You simply cannot fit two floppy-disk drives, a CRT display and a printer mechanism into a briefcase. But flat screen displays are on the way, and soon we will be able to dispense with one of the floppy-disk drives, using inexpensive RAM or bubble memory

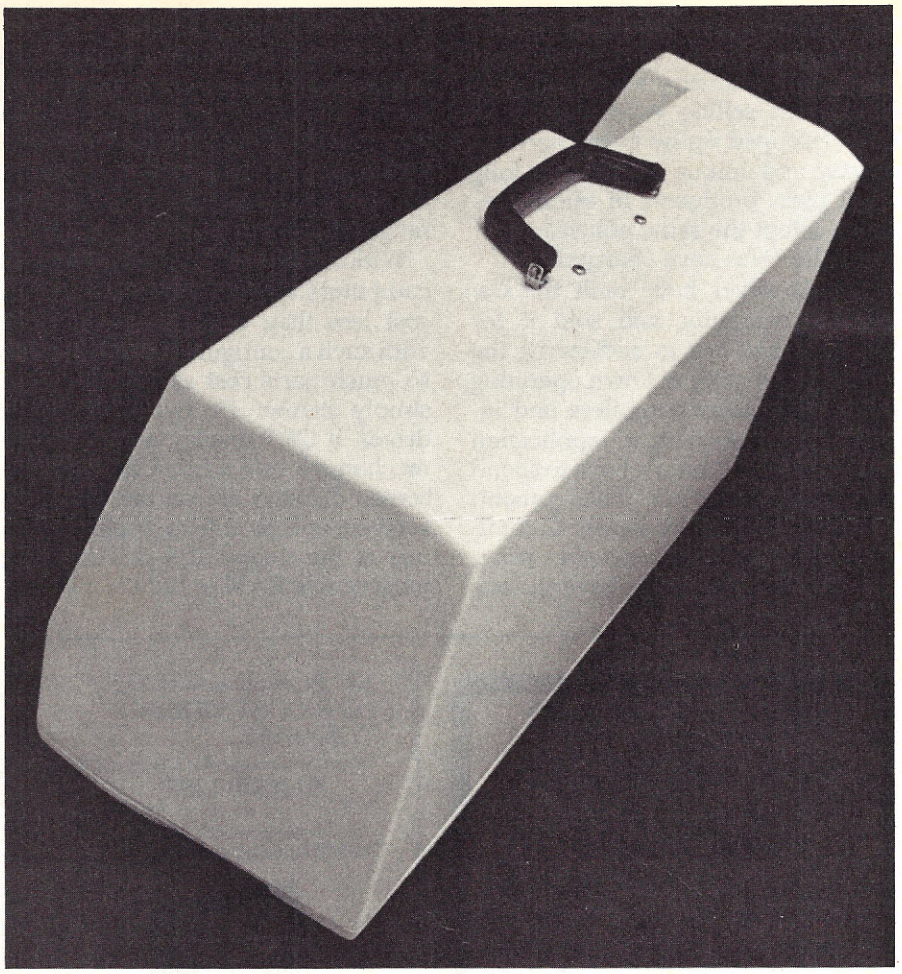
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Osborne's microcomputer system in a briefcase.

to provide bulk storage, while a single floppy-disk drive functions as a backup device.

The current and future markets for microcomputers such as the Osborne I are as ubiquitous as today's typewriter market. The Osborne I is almost as compact, and almost as inexpensive, as an electric typewriter; and it is just as portable. I project that sales for this new type of microcomputer will surpass a quarter of a million units in 1982, a million units in 1983 and many millions annually thereafter.

All these sales will not go to the Osborne I, of course. The Osborne I is just the first entry in this new class of microcomputer. By 1983 it will have a lot of company.

Looking Ahead

Low-cost microcomputer systems will have a profound impact on our daily work habits.

Consider the hallowed tradition whereby secretaries type letters for bosses. Using a microcomputer, a boss could write a letter in less time than it takes to prepare the information for the secretary and then proof the secretary's work.

Managers will no longer be able to depend on underlings to generate financial data. Today it can take weeks for a cash-flow analysis or financial forecast to percolate up from the low-level flunky who generates the data, through the many levels of management of a large corporation, to the bosses who use this information. In the future the boss will prepare this information himself or herself. The information will then flow from the top down.

There is a ruthless inevitability to these changes in white-collar work habits. White-collar professionals who adopt microcomputers will significantly outperform their coworkers. Coworkers will have the option of joining the revolution or changing their profession.

Consider next the flow of information. Instead of sending typed letters and memos, it will be far more efficient to send diskettes—or simply to transmit the data over communications lines. Networking for computers in the future represents one of the most challenging frontiers facing the microcomputer industry.

Microcomputers must communicate directly with each other over telephone lines to permit point-to-point messages. Using a microcomputer with a battery pack, attorneys will be able to work on a brief while flying coast to coast, then send the edited material from a hotel room back to the law office. Journalists, likewise, will be able to write their stories on a word processing system and telephone the result from any point in the world to the home office. Microcomputers connecting with large central computers will be able to access and contribute to central databases.

Soon the concept of a central office will be questioned. Why should commuters suffocate in traffic jams twice a day when they could do 90 percent of their work at home with a microcomputer and telephone? Perhaps offices should be nothing more than conference rooms, where people meet for those meetings that really do require the physical attendance of participants.

Certainly microcomputers will force white-collar professionals to become more efficient in their work habits. Human nature may slow down this march toward greater white-collar efficiency, but won't stop it.

Although we may argue about the impact that microcomputers will have on white-collar professionals, the future of the microcomputer industry itself is now quite clear.

You are about to witness a new, massive round of hardware price reductions.

The microcomputer industry is about to separate completely into hardware and software branches. Software vendors will generate industry-standard programs. Hardware manufacturers will build industry-standard microcomputers. Those who stray from industry standards will be forced to leave the microcomputer marketplace.

The microcomputer industry differs radically from any type of computer industry that has preceded it. Those who run microcomputer companies along minicomputer lines will fail, because some of us will do the job as it should be done. Economics overwhelmingly favors the first microcomputer manufacturers who understand the microcomputer for the different product that it is.■

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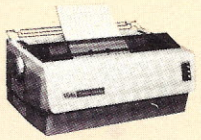


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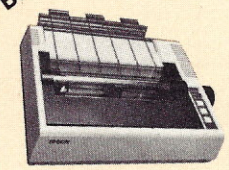
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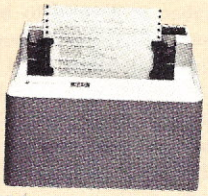
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Discover some of the hidden features of HIRES graphics with RAM Applesoft.

The Animated Apple II

By Edward Burlbaw

The Apple II is well known for its HIRES graphics capability. Two HIRES screens are available—unless you are using Applesoft Floating Point BASIC in RAM (commonly called RAM Applesoft or cassette Applesoft). RAM Applesoft is loaded into memory from (hex)$800 to $2FFF. Looking at Appendix 1 of the Applesoft manual, you see that HGR (the first HIRES screen) is located at $2000 to $3FFF. Because Applesoft is loaded into memory used by that screen, you are warned by the manual that only HGR2 should be used with RAM Applesoft. HGR2, $4000 to $5FFF (16K–24K), then, is outside the area used by Applesoft.

Because of this, at least 24K is needed for graphics with RAM Applesoft. With 24K of RAM a program requiring graphics is restricted to less than 4K ($3000–$3FFF), or calling HGR2 will erase part of the program. You can have longer programs only if you have more memory.

Memory is cheap, so the first thing most Apple owners do is buy a full complement of memory to have a 48K machine. That's what I did, anyway.

To achieve animation you will need at least two screens that can be displayed alternately; that is, while you draw the graphics on the hidden screen, the other screen is being displayed, and when you are finished drawing, you switch screens. With only one screen available, you have to watch while the drawing is taking place. This is fine for some things, but for true animation a completely updated screen must be presented in less than the blink of an eye. At first glance this seems impossible if you are using RAM Applesoft (with only one screen)—not true!

The technique for acquiring an additional HIRES screen for your Apple (actually a choice of three additional screens) was developed for and is incorporated in the RAM Applesoft version of a commercially available program. The Space Shuttle Landing Simulator (available from H.S.S.R., PO Box 3478, University Park, Las Cruces, NM, 88003) displays in correct perspective an out-of-cockpit view of the landing strip, on a background of grass, with a mountain on the horizon and a cloud in the blue sky. With graphics this elaborate, plotting done in plain view would be unacceptable.

Background and Development

There is nothing special about the memory used for the HIRES screens. The difference is in the hardware that allows that section of memory to be displayed. Whatever is in memory locations 16K–24K will be displayed on the video readout (providing HGR2 has been initialized).

The technique I developed is simply to plot in memory 40K–48K ($A000.BFFF), and then move that section of memory to the HGR2 memory area. If you only have 32K you can still use this method, as I will explain later how to use 24K–32K memory locations instead.

Before detailing how this is done, let me introduce and explain some commands and switches in the Apple. Some of this information can also be found in the Applesoft manual.

HGR—sets HIRES graphics mode (280×160) leaving bottom four lines of text. Page one (8K–16K) is displayed. To be strictly avoided with RAM Applesoft.

HGR2—full-screen HIRES graphics mode (280×192). The screen is cleared to black and page two of memory is displayed. With RAM Applesoft it is not possible to display mixed graphics/text because page two of text (2K–3K) is used by Applesoft.

POKE −16304,0—switch to graphics display without clearing screen to black.

POKE −16299,0—page two of text or HIRES.

POKE −16297,0—HIRES page one or page two graphics.

POKE −16302,0—full screen hi- or low-res. graphics.

Address correspondence to: Edward Burlbaw, 945 Brook Circle, Las Cruces, NM 88001.

```
5  REM       THIS PROGRAM DISPLAYS
     A COMPLETE SCREEN OF EACH
     COLOR PAUSING AT EACH
10  DATA  0,42,85,127,170,213,255

20  HGR2
30  FOR A = 1 TO 7
40  READ X
50  POKE 28,X: REM  SET UP HCOLOR

60  CALL 11250: REM  CLEAR SCREEN
      TO HCOLOR
70  FOR I = 1 TO 2500: NEXT : REM
      PAUSE
80  NEXT
90  TEXT
99  END
```

Listing 1.

```
5  REM  AN INTERESTING PROGRAM
20  HGR2
40  FOR X = 0 TO 255
50  POKE 28,X: REM  SET UP HCOLOR

60  CALL 11250: REM  CLEAR SCREEN
      TO HCOLOR
70  FOR I = 1 TO 200: NEXT
80  NEXT
90  TEXT
99  END
```

Listing 2.

```
100  REM   THIS PROGRAM PLOTS A
       WHITE STAR ON A BLUE BACK-
       GROUND.  THE STARS POSITON
       IS CONTROLLED BY THE PADDLES

110  HGR2
120  POKE 28,213: CALL 11250: REM
       CLEAR SCREEN TO BLUE
130 X = 1.02 *  PDL (0):Y = 191 -
     .75 *  PDL (1)
140  IF X < 20 THEN X = 20
150  IF Y < 20 THEN Y = 20
160  IF X > 260 THEN X = 260
170  IF Y > 175 THEN Y = 175
180  REM  PREVIOUS FOUR LINES
       PROTECT BOUNDARIES
190 X1 = X:Y1 = Y - 20


200 X2 = X - 19:Y2 = Y - 6
210 X3 = X - 12:Y3 = Y + 16
220 X4 = X + 12:Y4 = Y3
230 X5 = X + 19:Y5 = Y2
240  REM  PREVIOUS FIVE LINES SET
       UP STAR POINTS
250  HCOLOR= 7
260  HPLOT X1,Y1 TO X3,Y3: HPLOT
       TO X5,Y5: HPLOT  TO X2,Y2::
       HPLOT  TO X4,Y4: HPLOT  TO
     X1,Y1
270  REM  PREVIOUS TWO LINES
     HPLOT WHITE STAR
280  GOTO 130
290  REM  CHANGE LINE 280 TO 'GO
     TO 120' TO GET ERASURE EACH
     TIME
```

Listing 3.

CALL 11246—clears current HIRES screen to black.

CALL 11250—clears current HIRES screen to last HCOLOR HPLOTed. This must be preceded by a plot.

The preceding commands and some others are described in the Applesoft manual on pp. 131–134 and pp. 87–88.

As you can see (by trying it out) executing the four POKEs is nearly equivalent to executing HGR2 except that the screen (memory) is not cleared to black. If the CALL 11246 is executed the screen is cleared to black and you have executed the HGR2 command equivalent. If instead you execute CALL 11250 (with its precedents) the screen will clear to the last HCOLOR.

Let me introduce an additional command.

POKE 28,COLR—this sets up the HCOLOR to be HPLOTed, where

COLR = 0—corresponds to HCOLOR=0: black,
42—corresponds to HCOLOR=1: green,
85—corresponds to HCOLOR=2: violet,
127—corresponds to HCOLOR=3: white #1,
170—corresponds to HCOLOR=5: orange,
213—corresponds to HCOLOR=6: blue,
255—corresponds to HCOLOR=7: white #2.

Listing 1 will demonstrate this. This program will cycle through the above seven colors, with a pause at each color, and return to text page when finished. If you get tired of the single color screen you can try this. Replace lines 30 and 40 by

40 FOR X=0 TO 255

and change the delay in line 70 to about 200. Listing 2 illustrates this.

In both of the above programs the screen is being filled with the new color(s) as you watch and has a venetian blind look to it. Ideally for animation we would like the entire screen to change color at once. If you will follow me through the next few steps you will see how to achieve this.

HPLOTing into the Memory of Our Choice

There is also a POKE which enables us to HPLOT into any section of memory we choose. Yeah, but... how will that help us? Wait and see.

POKE 230,SCREEN#,

where

SCREEN# = 32—HGR (8K–16K),
64—HGR2 (16K–24K),
96—'HGR3' (24K–32K),
128—'HGR4' (32K–40K),
160—'HGR5' (40K–48K),

The value in location 230 ($E6) determines where the HPLOT 0,0 is located in memory. I suppose if you wanted to you could use other values for SCREEN# but these ranges of memory seem most convenient.

Here is a more interesting program (Listing 3) which I will use as an example for the rest of this article. Listing 3 will also justify the need for animation better than the previous programs. I wanted a simple program that you would key in.

After keying in Listing 3, run it to get an idea how it works. Then change line 280 to read

280 GO TO 120.

Now you can see how shoddy it looks to erase and replot as you are watching.

The following changes and additions will demonstrate HPLOTing on the 40K–48K screen, 'HGR5', and using the monitor memory move subroutine to move that memory to HGR2. First to HPLOT on 'HGR5',

115 POKE 230,160.

Then to initialize the monitor routine add this subroutine,

1000 POKE 66,0: POKE 67,64
(destination address)
1010 POKE 60,0: POKE 61,160
(source start address)
1020 POKE 62,0: POKE 63,192
(source end address)
1030 CALL -468
(monitor move call)
1040 RETURN

Finally add this line,

275 GOSUB 1000.

If you did not change line 280 as instructed above, do it now. Run your new version of Listing 3.

You can still see the venetian blind effect. This is because the monitor memory move routine is quite slow compared to a move routine dedicated to the job of moving 8K of data from (starting at) 40K to 16K.

By this time you are either bored with all this or interested in seeing some really slick work. So, if you are still with me, here is a move subroutine that I adapted for the job from the *MOS Technology MCS6500 Microcomputer Family Programming Manual, 2nd ed.*, p. 95.

After you have made the changes in lines 105, 275 and 1000–1040 (deleted), the material in your Apple should look like Listing 4. Run the program.

You should be able to move the star around the screen and hardly see the image changing. Because the HPLOT is done in BASIC there is some delay

```
100  REM   THIS PROGRAM PLOTS A
      WHITE STAR ON A BLUE BACK-
      GROUND.  THE STARS POSITON
     IS CONTROLLED BY THE PADDLES

105  GOSUB 2000
110  HGR2
115  POKE 230,160
120  POKE 28,213: CALL 11250: REM
      CLEAR SCREEN TO BLUE
130 X = 1.02 *  PDL (0):Y = 191 -
     .75 *  PDL (1)
140  IF X < 20 THEN X = 20
150  IF Y < 20 THEN Y = 20
160  IF X > 260 THEN X = 260
170  IF Y > 175 THEN Y = 175
180  REM  PREVIOUS FOUR LINES
     PROTECT BOUNDARIES
190 X1 = X:Y1 = Y - 20
200 X2 = X - 19:Y2 = Y - 6
210 X3 = X - 12:Y3 = Y + 16
220 X4 = X + 12:Y4 = Y3
230 X5 = X + 19:Y5 = Y2
240  REM  PREVIOUS FIVE LINES SET
      UP STAR POINTS
250  HCOLOR= 7
260  HPLOT X1,Y1 TO X3,Y3: HPLOT
      TO X5,Y5: HPLOT  TO X2,Y2::
      HPLOT  TO X4,Y4: HPLOT  TO
     X1,Y1
270  REM  PREVIOUS TWO LINES
     HPLOT WHITE STAR
275  CALL 768
280  GOTO 120
2000  DATA     169,0,133,6,169,16
     0,133,7,169,0,133,8,169,64,1
     33,9,162,32,160,0,177,6,145,
     8,136,208,249,230,7,230,9,20
     2,48,6,208,240,160,0,208,236
     ,96
2010  FOR I = 1 TO 41
2020  READ AX
2030  POKE 767 + I,AX
2040  NEXT
2050  REM   THIS SUBROUTINE '2000
     -2060' SETS UP THE MEMORY
     MOVE SUBROUTINE STARTING AT
     $300.  TO MOVE 40K-48K  TO
     16K-24K --CALL 768
2060  RETURN
```

Listing 4.

```
0300- A9 00 85 06 A9 A0 85 07
0308- A9 00 85 08 A9 40 85 09
0310- A2 20 A0 00 B1 06 91 08
0318- 88 D0 F9 E6 07 E6 09 CA
0320- 30 06 D0 F0 A0 00 D0 EC
0328- 60
```

Memory Dump of Memory Move routine.

between paddle movement and image movement.

If you would now like to use this technique in your own programs, simply do the following:

- key in the subroutine at lines 2000–2060,
- include a GOSUB 2000 command early in the program to put the program at location 768 ($300),
- HGR2 to initialize graphics mode,
- POKE 230,160,
- (place your graphics program here),
- CALL 768, and
- loop back into graphics program.

It is probably a good idea to set

```
*300LL

0300-   A9 00       LDA   #$00
0302-   85 06       STA   $06
0304-   A9 A0       LDA   #$A0
0306-   85 07       STA   $07
0308-   A9 00       LDA   #$00
030A-   85 08       STA   $08
030C-   A9 40       LDA   #$40
030E-   85 09       STA   $09
0310-   A2 20       LDX   #$20
0312-   A0 00       LDY   #$00
0314-   B1 06       LDA   ($06),Y
0316-   91 08       STA   ($08),Y
0318-   88          DEY
0319-   D0 F9       BNE   $0314
031B-   E6 07       INC   $07
031D-   E6 09       INC   $09
031F-   CA          DEX
0320-   30 06       BMI   $0328
0322-   D0 F0       BNE   $0314
0324-   A0 00       LDY   #$00
0326-   D0 EC       BNE   $0314
0328-   60          RTS
```

Disassembled Memory Move routine.

HIMEM: 40960 early in the program to protect 40K–48K.

I should add that the memory move routine is completely relocatable and can be placed anywhere you like, providing you don't overwrite Applesoft, HGR2 or 'HGR5'.

Now that you have the basic tools and procedures, here are some options and additional information. If you want to include the memory move routine with a machine-language program that loads somewhere else in memory, that's fine. A disassembled version of the routine and a memory dump are included with this article.

If you would rather use 'HGR3' or 'HGR4' it is necessary only to change the sixth entry in the data statement (line 2000) from 160 to 96 or 128, respectively, and POKE 230 with the corresponding number. The sixth data entry is location (dec) 773 or $305.

If your Applesoft program is longer than 4K you will be unable to use the HGR2 unless you load the program above 24K. To do this a simple POKE is necessary. POKE 104 ($68) with the hibyte of the desired beginning of the program. POKE 104,96 will begin loading at 24K ($6000). Likewise, poking 128 or 160 corresponds to 32K and 40K, respectively.

In order for this to work on all Apples you must POKE the first three starting memory locations with a 0. For example, POKE 24576,0, POKE 24577,0, and POKE 24578,0 to begin loading correctly at 24K.

One alternative might be to begin loading the program at 32K and use 'HGR3' for your other HIRES screen. This would require the appropriate change in the memory move routine. I used 'HGR5' as my primary example because that was what I had used for my purposes.

I understand that DOS resides in the higher memory locations (I don't have a disk, yet) so possibly there is an advantage in using 'HGR3' rather than 'HGR5'. If your program fits between 32K and DOS you wouldn't crash DOS.

One hidden advantage of loading your program above HGR2 is that you now have more room for machine-language programs. Locations $3000–$3FFF are now free for 4K of machine-language programs of your choice. Since DOS uses some of the free space, $300–$3F7, it's nice to have that 4K sitting there.

One thing you will have noticed by now about HGR2 is that it's impossible to get the bottom four lines TEXT as is available on HGR. The HIRES Character Generator programs work on the new HIRES screens. The program from the Apple Contributors Library Vol. 3–5, for example, describes a POKE to location 974 of 32 for p. 1, 64 for p. 2, and now I add 96 for p. 3, 128 for p. 4, and 160 for p. 5. It's all very easy once you know how!

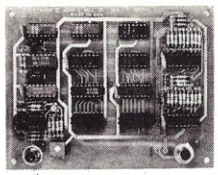
This technique is simple in principle and not much harder in application. HPLOTing in another section of memory requires only one POKE, and changing screens is an easy memory move done with a CALL.

Summary

I certainly hope that I haven't overwhelmed you with too much information. What I hope I have done is led you through a discovery of some of the hidden details of high-resolution graphics. I have tried to explain each step with exemplary programs short enough to key in as we went along from step to step. I also wanted to use programs that made some use of animation without being too complicated. I developed this technique of simulating another HIRES screen for use by a program with very elaborate graphics, where having two screens was mandatory.

I think that if you followed along you will now have a useful tool for your own programs, and will no longer feel cheated out of the two HIRES screens by cassette Applesoft. Surprise and amaze your friends with ROM cards at your next club meeting by showing off your two-screen animation.■

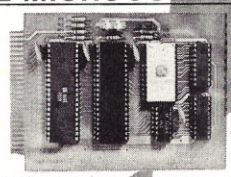
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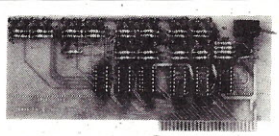
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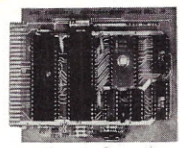
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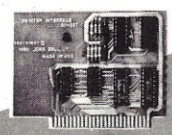
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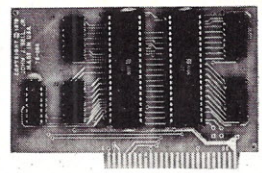
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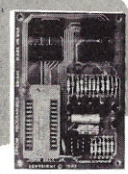
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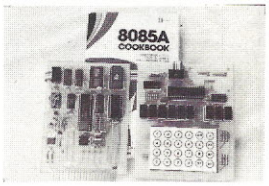
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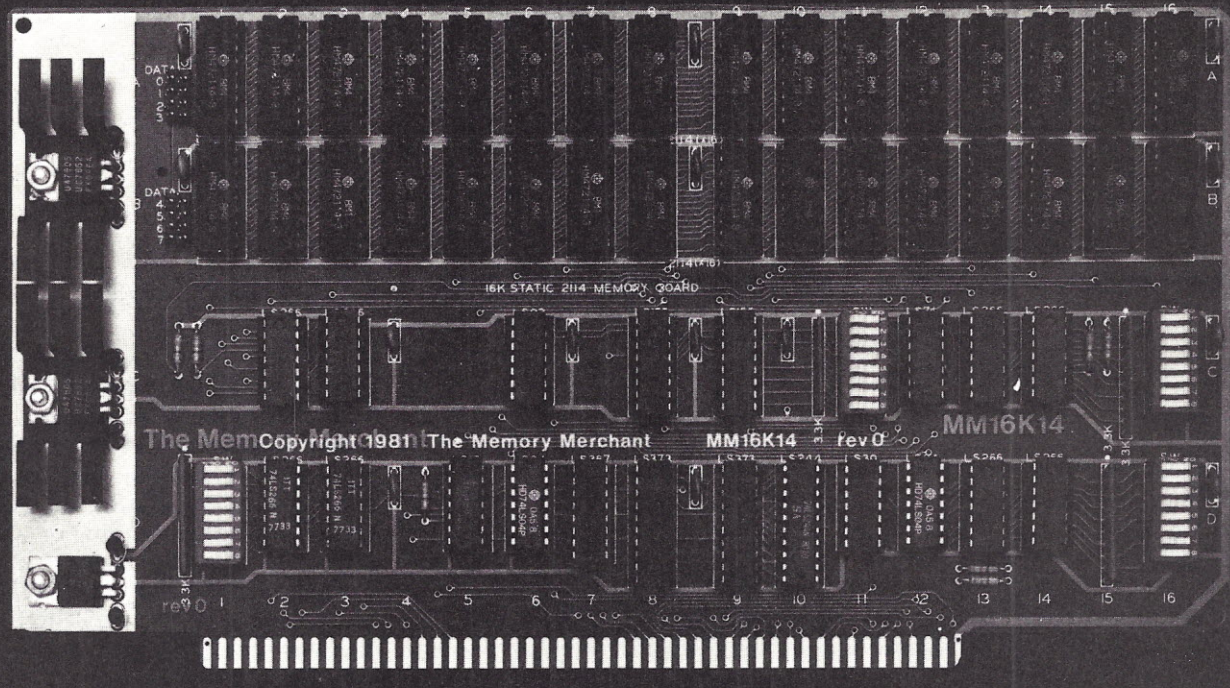
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Index it fast with this Heath disk BASIC business system.

Datalog

By Raymond Massa

One of Benton Harbor Disk BASIC's biggest drawbacks is its lack of random access disk manipulation. The sequential file structure supported by B.H. BASIC is good, but rather slow when reading or writing large data files. One factor contributing to this is the need of FOR/NEXT loops along with an IF/THEN statement to check for the appropriate data being searched for.

Also, using the string functions to concatenate the common fields of any given record, and later to decode these strings, places an additional burden on the execution speed of the program.

This led me to develop a disk program that would overcome these obstacles as much as possible without having to sacrifice a great deal. I did this by using an index that is created along with the data that you enter. This index is a brief description of the main data record, indicating the job number, its title, date of entry and number of pages that exist for that particular record.

When searching for a specific record, the program looks up its associated number in the index, and if found, confirms the fact that a record by that number does exist. This is important, since each datum is written

Address correspondence to Raymond Massa, 125 Aspen, Birmingham, MI 48009.

Listing 1. Header.log program in Benton Harbor Disk BASIC.

```
00010 REM      ******* DATALOG ********
00020 REM
00030 REM            Ray Massa
00040 REM            Version 7.0
00050 REM
00060 REM
00070 REM      **********************
00080 REM
00090 REM             HEADER.LOG
00100 REM
00110 GOSUB 1690
00120 PRINT TAB(35);"   DATALOG   "
00130 PRINT :PRINT :PRINT
00140 DIM C$(150),A$(150),R8(150),E$(150),B$(150),C1$(28)
00150 D5$="":D1$="":FOR I=8383TO 8391:D1$=CHR$(PEEK(I)):D5$=D5$+D1$:NEXT I
00160 D5$=MID$(D5$,4,3)+"."+LEFT$(D5$,2)+", 19"+RIGHT$(D5$,2)
00170 LINE INPUT "ENTER THE YEAR OF THE DATA LOG YOU WISH TO ACCESS: ";Y$
00180 Z$="SY0:LOG"+RIGHT$(Y$,2)+"HDR.DAT" :PRINT
00190 PRINT :IF Y$<>"NEW"GOTO 590
00200 PRINT
00210 LINE INPUT "ENTER YEAR OF THE FILE YOU WANT TO CREATE: ";Y$
00220 Z$="SY0:LOG"+RIGHT$(Y$,2)+"HDR.DAT" :PRINT
00230 IF VAL(Y$)<1970GOTO 210
00240 PRINT "ENTER STARTING JOB# FOR "Y$;:LINE INPUT ": (4 digits)  ";J$ :PRINT
00250 IF LEN(J$)<>4 THEN PRINT :PRINT "ERROR--Please enter a 4 digit number.":GO
TO 240
00260 PRINT "WILL NOW WRITE THE FOLLOWING DATA TO DISK,IF INFORMATION IS CORRECT
."
00270 D3$=D5$
00280 PRINT
00290 PRINT
00300 PRINT TAB(13)"Name of File:";TAB(50);Z$
00310 PRINT
00320 PRINT TAB(13)"Date of Creation:";TAB(50);D3$
00330 PRINT
00340 PRINT TAB(13)"Number of Disks Used For ";Y$;": ";TAB(49);E
00350 X=E:IF X=0THEN X=1
00360 PRINT
00370 PRINT TAB(13)"Total Records For ";Y$;": ";TAB(49);[(X-1)*150]+V
00380 PRINT
00390 PRINT TAB(13)"Number of Records on Latest Disk:";TAB(49);V
00400 PRINT
00410 PRINT TAB(13)"Starting Job Number For ";Y$;":";TAB(50);J$
00420 PRINT
00430 IF A9$=""THEN A9$=STR$(VAL(J$)-1)
00440 PRINT TAB(13)"Next Available Job Number For Use:";TAB(49);VAL(A9$)+1
00450 PRINT :PRINT
00460 IF R2>0GOTO 770
00470 PRINT :PRINT :PRINT :PRINT
00480 INPUT "ANY CHANGES? ";X$
00490 IF X$="Y"THEN A9$="" :GOSUB 1680 :GOTO 200
00500 IF X$<>"N"GOTO 480
00510 :
00520 REM     WRITE HEADER FILE
00530 OPEN Z$ FOR WRITE AS FILE #1
00540 PRINT #1,Z$:PRINT #1,D3$:PRINT #1,E:PRINT #1,J$:PRINT #1,A9$
00550 PRINT #1,Y$:PRINT #1,V
00560 CLOSE #1
00570 GOTO 650
00580 :
00590 REM    READ HEADER FILE
00600 OPEN Z$FOR READ AS FILE #1
00610 LINE INPUT #1,;Z$:LINE INPUT #1,;D3$:INPUT #1,;E:LINE INPUT #1,;J$
00620 LINE INPUT #1,;A9$:LINE INPUT #1,;Y$:INPUT #1,;V
00630 CLOSE #1
00640 :
```

More

to the disk as a separate file with a completely unique name. This explains how data can be retrieved so quickly without random access files.

After the record number is confirmed as valid, the program directly reads the data from the disk, using the record number preceded by the letter M as the file name. The letter M is needed because all legal file names must start with an alphabetical character.

Immediately following the last digit of the record number is the letter P, followed by a numeral 1 through 9. This represents the page number of the data. This will be explained in greater detail later.

General Functions

DataLog.Bas runs under B.H. Disk BASIC and requires a minimum of 32K of RAM memory, an H19 terminal and dual disk drives. An H-89 Heath computer can also be used, as long as it is equipped with the above configuration. A printer is not a must, but the program can accommodate one if available.

Datalog lets you keep records of virtually any size in a very organized manner. Records of any type or variety in any sequence can be entered without problems. At the same time, it has provisions for computing the total number of items on a cost/size basis. Although this feature was written to keep track of the cost of photostats for an art studio, it is easily adaptable to your needs by changing the necessary print and input statements described later.

In addition to this, it automatically constructs an index for all the data you enter. This gives you an organized listing of all accounts on the disk.

DataLog.Bas lets you search for a job in any one of four ways. It has complete provisions for errors made or entry of additional data, and displays a summary of pertinent year-to-date information.

Since the code for this program is rather lengthy, it has been subdivided into four separate sections, thus enabling the program to store and execute in 32K of memory. Using the CHAIN command, the four modules interact with each other under program control.

Capabilities

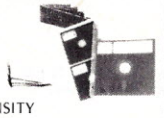
If each record length does not exceed two sectors in size (512 charac-

Listing 1 continued.

```
00650 REM     PRINT HEADER INFO.
00660 PRINT TAB(31)Y$" DATA LOG":PRINT
00670 PRINT TAB(19)"For the Records of (Insert Company Name)"
00680 PRINT
00690 R2=1
00700 PRINT CHR$(27);CHR$(70);
00710 FOR S2=1TO 79:PRINT CHR$(97);:NEXT
00720 PRINT
00730 PRINT CHR$(27);CHR$(71);
00740 GOTO 290
00750 :
00760 REM     SET UP INDEX / CHECK DISK#
00770 Q9=E
00780 IF E=0THEN E=1
00790 PRINT :PRINT
00800 PRINT " Enter Disk# Beins Used:  (1 to";E")  ";:LINE INPUT "";L2$
00810 IF VAL(L2$)<1 OR VAL(L2$)> E THEN PRINT "===INVALID FILE NUMBER===":PRINT
:GOTO 800
00820 I$="SY1:INDEX"+L2$+".DAT"
00830 IF Q9=0THEN GOSUB 1510:GOTO 900
00840 IF V=0AND VAL(L2$)=E THEN GOSUB 1510:GOTO 900
00850 GOSUB 1580
00860 :
00870 :
00880 REM     OPTION LIST
00890 REM
00900 GOSUB 1690
00910 PRINT :PRINT :PRINT
00920 PRINT TAB(25)"1........Input New Data":PRINT
00930 PRINT TAB(25)"2........Examine Data":PRINT
00940 PRINT TAB(25)"3........Update Data":PRINT
00950 PRINT TAB(25)"4........View Index":PRINT
00960 PRINT TAB(25)"5........Print Index":PRINT
00970 PRINT TAB(25)"6........End Program":PRINT
00980 PRINT :PRINT :PRINT TAB(22);:LINE INPUT " ENTER:   ";X$
00990 ON LNO(VAL(X$)) GOTO 1010,1020,1030,1160,1180,1060
01000 GOTO 980
01010 CHAIN "NEWDATA.LOG"
01020 CHAIN "EXAMINE.LOG"
01030 CHAIN "UPDATE.LOG"
01040 :
01050 :
01060 REM     END PROGRAM
01070 GOSUB 1690
01080 PRINT CHR$(12)
01090 PRINT TAB(22)"E N D   D A T A   L O G   P R O G R A M"
01100 PRINT :PRINT :PRINT
01110 PRINT TAB(23);" TYPE 'BYE' and UPDATE BACK-UP DISK "
01120 PRINT :PRINT
01130 END
01140 :
01150 :
01160 REM     SET TT:/LP:
01170 T8$="TT:" :GOTO 1200
01180 T8$="LP:"
01190 M5=1
01200 GOSUB 1580
01210 :
01220 :
01230 REM     VIEW/PRINT INDEX
01240 GOSUB 1690
01250 Q8=0
01260 OPEN T8$ FOR WRITE AS FILE #2
01270 PRINT #2,""TAB(35);Y$;" INDEX ";TAB(65)" [ disk #";L2$" ]"TAB(79)"  "
01280 PRINT #2,
01290 PRINT #2,"Title"TAB(34)"Job #"SPC(7)"Pases"SPC(9)"Date"SPC(8)"Status"
01300 FOR S2=1TO 78 :PRINT #2,"=";:NEXT
01310 S2=0
01320 IF Q8=77GOTO 1360
01330 FOR X=1TO V
01350 X$=""
01360 S2=S2+1
01370 IF M5=1 AND S2=55 THEN Q8=77 :GOTO 1290
01380 IF M5=1 GOTO 1410
01390 IF S2=11 THEN CLOSE #2 :PAUSE :Q8=77: GOSUB 1690
01400 IF S2=11THEN OPEN T8$ FOR WRITE AS FILE #2 :PRINT #2, :GOTO 1290
01410 PRINT #2,
01420 IF A$(X)=""THEN CLOSE #2:PRINT "<CR>";:PAUSE :Q8=77:GOTO 900
01430 PRINT #2,X$+LEFT$(C$(X),32)TAB(33)RIGHT$(A$(X),6)TAB(47)R8(X)TAB(56)E$(X)T
AB(73)B$(X)
01440 NEXT X
01450 GOTO 1420
01460 :
01470 :
01480 REM     SUBROUTINES
01490 REM
01500 REM     OPEN NEW INDEX
01510 OPEN I$ FOR WRITE AS FILE #1
01520 FOR X=1TO V
01530 PRINT #1,C$:PRINT #1,A$:PRINT #1,R8:PRINT #1,E$:PRINT #1,B$
01540 NEXT X
01550 CLOSE #1
01560 RETURN
01570 :
01580 REM     READ INDEX
01590 OPEN I$ FOR READ AS FILE #1
01600 FOR X=1 TO V
01610 LINE INPUT #1,;C$(X) :LINE INPUT #1,;A$(X) :INPUT #1,;R8(X)
01620 LINE INPUT #1,;E$(X) :LINE INPUT #1,;B$(X)
01630 NEXT X
01640 CLOSE #1
01650 RETURN
01660 :
01670 REM
01680 REM     CLEAR SCREEN
01690 PRINT CHR$(27);CHR$(69)
01700 RETURN
01710 :
01720 REM     END
```

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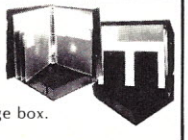


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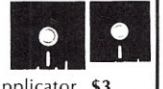


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ters per record), there will be room for 150 records on one disk. A completely packed record can use up to five sectors, in which case 75 records

Listing 2. Newdata program.

```
00010 REM      ****** NEWDATA.LOG ******
00020 REM
00030 REM             Ray Massa
00040 REM        Function #1 of Datalog
00050 REM             Version 7.0
00060 REM
00070 REM      ************************
00080 REM
00090 GOSUB 2780
00100 IF V=0 AND VAL(L2$)<> E THEN GOSUB 2910 :CHAIN "HEADER.LOG",880
00110 IF G9=0GOTO 140
00120 IF V=0GOTO 140
00130 GOTO 190
00140 V=0
00150 REM      IF FIRST RECORD
00160 IF G9=0THEN A9$=" "+J$ :V=V+1 :GOTO 230
00170 REM      IF FIRST RECORD ON NEW DISK
00180 IF V=0THEN V=V+1 :GOTO 230
00190 V=V+1
00210 A9$=STR$(VAL(A9$)+1)
00220 :
00230 REM      CLEAR ALL PROMPT VARIABLES
00240 J1$="" :J2$="" :J3$="" :J4$="" :J5$="" :J6$="" :J7$="" :K1$="" :K2$=""
00250 K3$="" :K4$="" :K5$="" :K6$="" :K7$="" :K$="" :L$="" :M$="" :N$="":O$=""
00260 :
00270 I=0
00280 GOSUB 2780
00290 REM      INDEX FLAG FOR PAGE #
00300 I9=0
00310 PRINT TAB(10)" Next Available Job#.. .....";A9$
00320 PRINT :PRINT
00330 PRINT TAB(10)"RECORD#";V"....ON FILE#";L2$
00340 PRINT CHR$(12)
00350 PRINT TAB(15):LINE INPUT "Enter Job#:  ";A$
00360 IF VAL(A$)<VAL(J$)THEN PRINT :PRINT "===INVALID JOB#===":GOTO 350
00370 IF LEN(A$)>4 THEN PRINT :PRINT "Maximum of 4 Digits, Please." :GOTO 340
00380 A3$=A$
00390 PRINT
00400 IF V>25 THEN PRINT "WORKING....."
00410 FOR X=1TO V
00420 IF VAL(RIGHT$(A$(X),6))=VAL(A$)THEN PRINT "Adding Page "R8(X)+1;:GOTO 450
00430 NEXT X
00440 GOTO 540
00450 PRINT " to Job# ";LEFT$(A$,4) :PRINT :PRINT
00460 IF R8(X)=9THEN PRINT "ERROR!--Maximum of 9 Pages/Job#":PAUSE 1000:GOTO 280
00470 PRINT TAB(5);:LINE INPUT "SURE? ";X$:PRINT CHR$(12)
00480 IF X$="Y"THEN I9=88 :R8=R8(X)+1 :GOTO 560
00490 IF X$<>"N"GOTO 470
00500 GOTO 280
00510 :
00520 :
00530 REM      SET PAGE# TO 1
00540 R8=1
00550 REM      PRINT ALL PROMPT ?'S
00560 GOSUB 2780
00570 PRINT :PRINT
00580 GOSUB 2820
00590 REM      GRAPHIC AND VIDEO ESC CODES ARE EMBEDDED WITHIN PRINT STATEMENTS
00600 PRINT "Faaaaaaaaaaaaaaaaaaaaaaaaaasaaaaaaaaaaaaaaaaaaa
```

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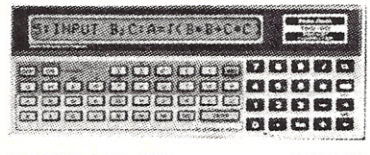
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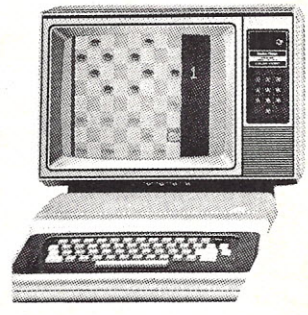
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Listing 2 continued.

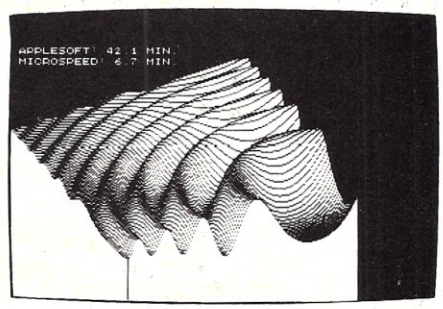
```
01020 :
01030 REM     ENTER 1 LINE OF WORK RECORD
01040 I=0
01050 FOR I2=1TO 14
01060 GOSUB 2820
01070 GOSUB 2780
01080 PRINT "faaaaaaaaaaaaaaaaaaaaaasaaaaaaaaaaaaaaaaaaa
```

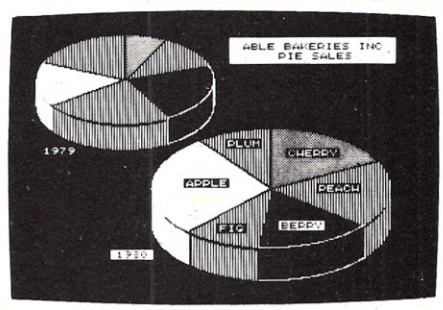
Listing 2 continued.

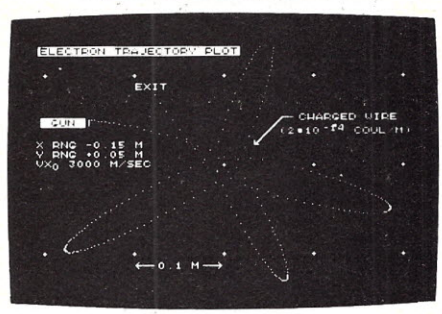
```
02030 IF I2=1GOTO 2060
02040 FOR D=1TO (I2-1)
02050 G$=G$+C1$(D)+"/":NEXT D
02060 IF LEFT$(C1$(I2),1)="G"THEN GOSUB 2100:GOTO 2170
02070 GOSUB 2100
02080 IF K=5GOTO 2170
02090 NEXT K
02100 IF K=1THEN K$=G$
02110 IF K=2THEN L$=G$
02120 IF K=3THEN M$=G$
02130 IF K=4THEN N$=G$
02140 IF K=5THEN O$=G$
02150 RETURN
02160 :
02170 :
02180 REM     FORMAT FILE NAME
02190 IF V=150THEN GOSUB 2910
02200 GOSUB 2780
02210 REM     ADD 'M' TO FILE NAME AND PAGE#
02220 A$="M"+A$+"P"+MID$(STR$(R8),2,1)
02230 PRINT "Record '";A$;"' Now Beins Written to File."
02240 W$="SY1:"+A$
02250 :
02260 :
02270 REM     WRITE TO FILE
02280 OPEN W$ FOR WRITE AS FILE #3
02290 PRINT #3,A$:PRINT #3,B$:PRINT #3,C$:PRINT #3,D$:PRINT #3,E$
02300 PRINT #3,F$:PRINT #3,G$:PRINT #3,H$:PRINT #3,I:PRINT #3,J1$:PRINT #3,J2$
02310 PRINT #3,J3$:PRINT #3,J4$:PRINT #3,J5$:PRINT #3,J6$:PRINT #3,J7$
02320 PRINT #3,K1$:PRINT #3,K2$:PRINT #3,K3$:PRINT #3,K4$:PRINT #3,K5$
02330 PRINT #3,K6$:PRINT #3,K7$:PRINT #3,K$:PRINT #3,L$:PRINT #3,M$
02340 PRINT #3,N$:PRINT #3,O$
02350 CLOSE #3
02360 :
02370 :
02380 C$(V)=C$ :A$(V)=A$ :R8(V)=R8 :E$(V)=E$ :B$(V)=B$
02390 IF V=150THEN V=0 :E=E+1
02400 G9=99
02410 :
02420 :
02430 REM     WRITE UPDATED HEADER INFO. TO DISK
02440 PRINT :PRINT "Header File Now Beins Updated."
02450 OPEN Z$ FOR WRITE AS FILE #1
02460 PRINT #1,Z$:PRINT #1,D3$:PRINT #1,E:PRINT #1,J$:PRINT #1,A9$
02470 PRINT #1,Y$:PRINT #1,V:CLOSE #1
02480 :
02490 :
02500 REM     UPDATE INDEX PAGE#
02510 REM
02520 REM     SKIP UPDATE IF NOT ADDING PAGE
02530 IF I9<>88GOTO 2600
02540 FOR X=1TO V-1
02550 IF VAL(RIGHT$(A$(X),6))=VAL(A3$) THEN R8(X)=R8(X)+1
02560 NEXT X
02570 :
02580 :
02590 REM     WRITE UPDATED INDEX TO DISK
02600 OPEN I$ FOR WRITE AS FILE #1
02610 FOR X=1TO V
02620 PRINT #1,C$(X) :PRINT #1,A$(X) :PRINT #1,R8(X)
02630 PRINT #1,E$(X) :PRINT #1,B$(X)
02640 NEXT X
02650 CLOSE #1
02660 :
02670 :
02680 GOSUB 2780
02690 PRINT :PRINT :PRINT
02700 LINE INPUT " Enter Another Job?   ";X$
02710 IF X$="Y"GOTO 10
02720 IF X$<>"N"GOTO 2680
02730 CHAIN "HEADER.LOG",880
02740 :
02750 :
02760 REM     SUBROUTINES
02770 REM
02780 REM     CLEAR SCREEN
02790 PRINT CHR$(27);CHR$(69)
02800 RETURN
02810 :
02820 REM     CURSOR OFF/ON
02830 PRINT CHR$(27);CHR$(120);CHR$(53);
02840 RETURN
02850 REM
02860 PRINT CHR$(27);CHR$(121);CHR$(53);
02870 RETURN
02880 :
02890 :
02900 :
02910 REM     BLINKER SUB.
02920 PRINT :PRINT :PRINT
02930 FOR S2=1TO 7
02940 PRINT CHR$(27);CHR$(75);
02950 PAUSE 100
02960 PRINT CHR$(13);
02970 PRINT "===END OF SPACE ON THIS FILE===";
02980 PRINT CHR$(7);:PAUSE 300
02990 PRINT CHR$(13);
03000 NEXT S2
03010 PRINT "End Program and Start a New Disk."
03020 PAUSE 900
03030 RETURN
03040 :
03050 :
03060 REM     CURSOR ADDRESSING     ( Ln          Col.)
03070 L3=L3+2
03080 C=27
03090 PRINT CHR$(27);CHR$(89);CHR$(32+L3);CHR$(32+C);
03100 RETURN
03110 REM     END
```


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is the maximum allowed. They will automatically be labeled with the correct page number.

The format for a job number that is recorded on the disk is MxxxxPt, where M is the first character of every job , so that it is a legal disk file name; xxxx represents your four-digit job number. P is a constant to separate the job number from the page number. And t is the actual page number.

Listing 3. Examine program.

```
00010 REM      ******* EXAMINE.LOG *******
00030 REM              Ray Massa
00040 REM              Version 7.0
00050 REM         Function #2 of Datalog
00070 REM      ***************************
00075 REM
00080 REM
00100 REM
00110 REM      M5=LP:FLAG  R3=SEARCH FLAG  L7=CONT.LIST FLAG
00120 M5=0
00130 R3=0
00140 L7=0
00150 CNTRL 0,3340
00160 GOSUB 3000
00170 PRINT "YOU MAY ACCESS A RECORD IN ANY OF THE FOLLOWING WAYS:":PRINT
00180 PRINT :PRINT TAB(22)"1.....JOB#":PRINT :PRINT TAB(22)"2.....SALESMAN'S NAM
E"
00190 PRINT :PRINT TAB(22)"3.....CATEGORY":PRINT :PRINT TAB(22)"4.....STATUS"
00200 PRINT :PRINT TAB(22)"5.....SINGLE STEP":PRINT :PRINT TAB(22)"6.....EXIT"
00210 PRINT :PRINT
00220 LINE INPUT " Enter:    ";X$
00230 IF VAL(X$)<1 OR VAL(X$)>6 GOTO 210
00240 IF X$="6"THEN CHAIN "HEADER.LOG",880
00250 GOSUB 3000
00260 PRINT :PRINT
00270 PRINT TAB(25)"1--Video terminal"
00280 PRINT TAB(25)"2--Printer"
00290 PRINT
00300 PRINT TAB(25);:LINE INPUT " Enter:  < 1 >  ";X2$
00310 IF X2$="2"THEN M5=1:T8$="LP:":GOTO 340
00320 IF X2$=""OR X2$="1" THEN T8$="TT:" :GOTO 390
00330 GOTO 250
00340 PRINT :PRINT :PRINT
00350 PRINT TAB(20);:LINE INPUT "List Hours?  ";X2$
00360 IF X2$="Y"THEN M8=0 :GOTO 390
00370 IF X2$="N"THEN M8=1:GOTO 390
00380 PRINT :GOTO 350
00390 GOSUB 3000
00400 ON LNO(VAL(X$))GOTO 430,2150,2290,2430,2570
00410 GOTO 210
00420 :
00430 PRINT :PRINT :PRINT
00440 LINE INPUT "  Enter Job# you Wish to Examine:    ";V$
00450 IF VAL(V$)<VAL(J$)THEN PRINT :PRINT TAB(30)"===INVALID JOB#===":GOTO 430
00460 IF LEFT$(V$,1)<>"M"THEN V$="M"+V$
00470 IF MID$(V$,6,1)<>"P"THEN V$=V$+"P1"
00480 W5=VAL(RIGHT$(V$,1))
00490 IF W5=0THEN W5=1
00500 W$="SY1:"+V$
00510 :
00520 REM      VERIFY JOB# IN INDEX
00530 FOR X=1TO V
00540 IF V$=A$(X)GOTO 590
00550 NEXT X
00560 PRINT :PRINT :PRINT TAB(21)"Job ";V$;" Not Found On This Disk"
00570 PRINT :PRINT "<CR>":PAUSE
00580 CLOSE #2:GOTO 100
00590 REM      READ DATA
00600 GOSUB 3040
00610 GOSUB 660
00620 GOTO 100
00630 :
00640 :
00650 REM      FORMULATE DISPLAY
00660 X2$=""
00670 OPEN T8$ FOR WRITE AS FILE #2
00680 REM      T=TOTAL HOURS  Y8=$ TOTAL  G=$ SUB-TOTAL
00690 T8=0
00700 T=0
00710 Y8=0
00720 G=0
00730 GOSUB 3000
00740 PRINT :PRINT
00750 IF R8(X)>1THEN PRINT "There are "R8(X)" Passes for this Job Number":GOTO 77
0
00760 GOTO 800
00770 PAUSE 800:
00780 GOSUB 3000
00790 PRINT #2,:PRINT #2,"<PAGE ";RIGHT$(W$,1);">":PRINT #2,
00800 PRINT #2,"Job# "RIGHT$(A$,6)" / "B$TAB(INT((80-LEN(C$))/2))C$TAB(80-LEN(D$
))D$
00810 PRINT #2,E$;TAB(80-LEN(F$))F$
00820 PRINT #2,TAB(INT((80-LEN(G$))/2))G$
00830 PRINT #2,TAB(INT((80-LEN(H$))/2))H$
00840 PRINT #2,
00850 GOSUB 3260
00860 :
00870 REM      DECODE A LINE OF TEXT
00880 B=0
00890 IF I=0GOTO 1170
00900 FOR P9=1TO I
00910 M=0
00920 IF P9=1THEN U$=J1$
00930 IF P9=2THEN U$=J2$
00940 IF P9=3THEN U$=J3$
00950 IF P9=4THEN U$=J4$
00960 IF P9=5THEN U$=J5$
00970 IF P9=6THEN U$=J6$
00980 IF P9=7THEN U$=J7$
00990 IF P9=8THEN U$=K1$
01000 IF P9=9THEN U$=K2$
01010 IF P9=10THEN U$=K3$
01020 IF P9=11THEN U$=K4$
```

More →

The program will prompt you on all necessary information to be entered. The Newdata input prompts are STATUS, JOB TITLE, CATEGORY, SALESMAN NAME, GENERAL DESCRIPTION, CLIENT JOB #, WORK RECORD AND PHOTOSTATS.

Job title is self-explanatory, but note that this is what will appear on the index. I suggest using something that will distinguish one job from another as much as possible for easy identification.

Status is a general-purpose entry. You can indicate whether the job is open, closed, paid or no-charge. The others are self-explanatory, but can be changed to meet your specific needs.

When entering text in the work record mode you are allowed a 14-line page. When that limit is met you are notified to start a new page. This method lets a job contain as many as 126 lines of data (14 lines×9 pages). The available entries in this section are the date that the work was done on, a description of the work done and the number of hours spent on the work.

Any of the three categories may be left without a response, but if all three are null (three successive carriage returns), then that line is deleted. You may leave lines blank by typing in at least one ASCII character in response to any of the three prompts.

In the photostat section, you can keep track of total dollar amounts on items that may be a variety of sizes and prices. In its current form, you will be prompted with five different photostat categories. They are: 8×10, 10×12, 11×14, 12×18 and 18×24.

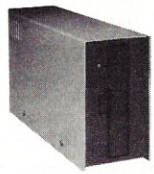
Each category works identically, so only one will be explained. When prompted with Enter→ you type in a numeric value that represents quantity, along with a two-letter code. The code designates a specific kind of photostat in this case. The eight valid codes are:

LN SC CP RV
BL K1 L2 K3

If a number is entered without one of the proper codes (no spaces between number and code), an invalid entry

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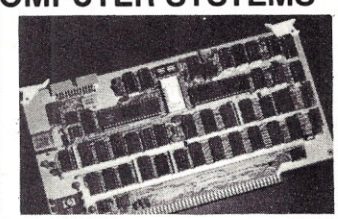
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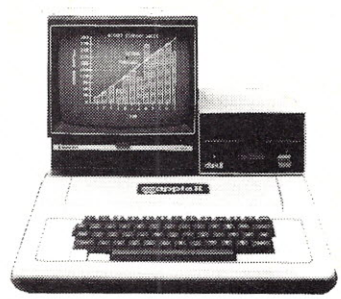




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Listing 3 continued.

```
01030 IF P9=12THEN U$=K5$
01040 IF P9=13THEN U$=K6$
01050 IF P9=14THEN U$=K7$
01060 FOR I2=1TO 3
01070 L=M+1
01080 M=MATCH(U$,"^",L):IF M=0GOTO 1110
01090 C1$(I2)=MID$(U$,L,M-L)
01100 NEXT I2
01110 REM
01120 REM      ALTERNATE LINE FOR NO-LIST HOURS
01130 IF M8=1THEN PRINT #2, :PRINT #2,C1$(1)TAB(12)C1$(2) :GOTO 1160
01140 PRINT #2,C1$(1)TAB(12)C1$(2)TAB(70)"|"SPC(2)C1$(3)
01150 T=T+VAL(C1$(3))
01160 NEXT P9
01170 GOSUB 3260
01180 IF R8(X)>1THEN PRINT #2,:PRINT #2,"Continued on Next Page.";
01190 IF M8=1GOTO 1280
01200 PRINT #2,TAB(58)"TOTAL HOURS:| "T
01210 IF M5=1GOTO 1270
01220 CLOSE #2
01230 IF L7=1GOTO 1260
01240 PRINT "<CR>";
01250 PAUSE
01260 OPEN T8$ FOR WRITE AS FILE #2
01270 GOSUB 3000
01280 PRINT #2,:PRINT #2,:PRINT #2,:PRINT #2,
01290 PRINT #2,TAB(27)"PHOTOSTATS FOR JOB# ";RIGHT$(A$,6)
01300 PRINT #2,
01310 GOSUB 3260
01320 REM      SET LP: TO 6 LPI
01330 IF M5=1THEN PRINT #2,CHR$(27);"y"
01340 FOR P=1TO 5
01350 M=0:G=0:D=1:C1$(D)=""
01360 :
01370 :
01380 REM      SET UP PRICES OF ITEMS
01390 REM
01400 REM    N1=LN, N2=SC, N3=RV, N4=CP, N5=CN, N6=BL, N7=K1, N8=K2, N9=K3
01410 REM
01420 IF P=1THEN U$=K$ :PRINT #2," 8 x 10    I"; :GOTO 1440
01430 GOTO 1470
01440 N1=5.00    :N2=5.85    :N3=6.00    :N4=5.50    :N5=7.50   :N6=12.0
01450 N7=15.00    :N8=20.00     :N9=25.00
01460 :
01470 IF P=2THEN U$=L$:PRINT #2,"10 x 12    I";:GOTO 1490
01480 GOTO 1520
01490 N1=5.5   :N2=6.5   :N3=8.00   :N4=6.50   :N5=8.50   :N6=13.00
01500 N7=17.00     :N8=22.00     :N9=27.00
01510 :
01520 IF P=3THEN U$=M$:PRINT #2,"11 x 14    I";:GOTO 1540
01530 GOTO 1570
01540 N1=6.50   :N2=7.50   :N3=10.00   :N4=7.50   :N5=10.50   :N6=15.00
01550 N7=20.00     :N8=24.00     :N9=30
01560 :
01570 IF P=4 THEN U$=N$:PRINT #2,"12 x 18    I";:GOTO 1590
01580 GOTO 1620
01590 N1=8.00   :N2=9.00   :N3=12.00   :N4=8.50   :N5=13.00   :N6=17.00
01600 N7=26.00     :N8=30.00     :N9=33.00
01610 :
01620 IF P=5THEN U$=O$:PRINT #2,"18 x 24    I";:GOTO 1640
01630 GOTO 1680
01640 N1=10.50   :N2=11.50   :N3=16.00   :N4=12.00   :N5=15.00   :N6=22.00
01650 N7=35.00     :N8=40.00     :N9=45.00
01660 :
01670 :
01680 W=LEN(U$)
01690 L=0
01700 L=M+1:IF L > W GOTO 1760
01710 M=MATCH(U$,"/",L):IF M=0GOTO 1760
01720 C1$(D)=MID$(U$,L,M-L)
01730 D=D+1
01740 C1$(D)=""
01750 GOTO 1690
01760 FOR H=1TO D
01770 IF H=11 OR H=20THEN PRINT #2,CHR$(13):PRINT #2,TAB(11)"I"TAB(12);
01780 PRINT #2,SPC(1)C1$(H);
01790 :
01800 REM      ADD PRICES OF ITEMS
01810 IF RIGHT$(C1$(H),2)="LN"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N1
01820 IF RIGHT$(C1$(H),2)="SC"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N2
01830 IF RIGHT$(C1$(H),2)="RV"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N3
01840 IF RIGHT$(C1$(H),2)="CP"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N4
01850 IF RIGHT$(C1$(H),2)="CN"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N5
01860 IF RIGHT$(C1$(H),2)="BL"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N6
01870 IF RIGHT$(C1$(H),2)="K1"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N7
01880 IF RIGHT$(C1$(H),2)="K2"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N8
01890 IF RIGHT$(C1$(H),2)="K3"THEN G=G+VAL(LEFT$(C1$(H),LEN(C1$(H))-2))*N9
01900 NEXT H
01910 IF G=0THEN PRINT #2,TAB(68)"$ 0.00":GOTO 1940
01920 GOSUB 3410
01930 PRINT #2,TAB(68)"$ ";G$
01940 Y8=Y8+G
01950 IF P=5GOTO 1970
01960 PRINT #2,"----------I----------
--------------"
01970 NEXT P
01980 REM      SET LP: TO 8 LPI
01990 IF M5=1THEN PRINT #2,CHR$(27);"x"
02000 GOSUB 3260
02010 PRINT #2,:PRINT #2,
02020 PRINT #2,TAB(45)"TOTAL AMOUNT...$ ";Y8
02030 CLOSE #2
02040 IF L7=1THEN RETURN
02050 PRINT "<CR>"::PAUSE
02060 IF R3=99THEN RETURN
02070 IF VAL(RIGHT$(W$,1))<R8(X)GOTO 2090
02080 RETURN
02090 IF W5=10THEN RETURN
02100 W5=W5+1
02110 W$="SY1:"+LEFT$(V$,6)+MID$(STR$(W5),2,1)
02120 GOSUB 3040
```

More

warning is displayed.

Each code, internally in the program, represents an amount in dollars and cents for a specific size photostat. The 8 × 10 category, for example, has provisions for entering all stats that are 8 × 10 in size, but may be one of eight different types and eight different prices.

Since there are five different size categories, and eight code names at present, the program as it stands will accept up to 40 different priced and sized items. Each size category will look up the price, compute and display the total dollar amount of all its entries, using the code to compute each cost separately.

This section can easily be modified by changing the input and print statements to suit your needs. The codes can be changed, along with the dollar amounts that they represent, to accommodate price changes in the items that you will use. You can also increase the number of categories and codes to any number by modifying the FOR/NEXT loops and input statements used in the photostat section.

To advance to a new stat size, hit return. When finished with this mode, type the letter Q to quit. At this point the completed record will be written to the disk file. You will then have the option of entering another job or returning to the menu.

Examine Data

If this option is selected, you can view any of the jobs that have already been entered. The program (Listing 3) will search for a requested job by job number, salesman's name, category name or status, or in single steps.

Simply select one of the above options, and then type in the specific job number, salesman's name and so on that you want to access. It must be typed exactly the way it was originally entered. Datalog will then search the file, and if found, display all information pertaining to that job.

Single-step mode lets you view all jobs on file in the order that they were entered.

You have the option of outputting the record to the video terminal or to a line printer. You may also select a CONTINUAL LIST mode. This means that the program will display all jobs that contain the same salesman's name, category or status that you requested without pausing in between each record. This also is a valid

Listing 3 continued.

```
02130 GOTO 660
02140 :
02150 REM     SALESMAN SEARCH
02160 N3$="SALESMAN'S NAME"
02170 GOSUB 2850
02180 FOR X=1TO V
02190 W$="SY1:"+A$(X)
02200 GOSUB 3040
02210 IF V$=F$THEN GOSUB 660:IF L7=0GOTO 2230
02220 NEXT X:GOSUB 3180:GOTO 100
02230 GOSUB 3000 :PRINT CHR$(12)
02240 PRINT "Examine the Next `";V$;"' Record?  ";:INPUT "";X$
02250 IF X$="Y"GOTO 2220
02260 IF X$<>"N"GOTO 2230
02270 GOTO 100
02280 :
02290 REM     CATEGORY SEARCH
02300 N3$="CATEGORY"
02310 GOSUB 2850
02320 FOR X=1TO V
02330 W$="SY1:"+A$(X)
02340 GOSUB 3040
02350 IF V$=D$THEN GOSUB 660 :IF L7=0 GOTO 2370
02360 NEXT X :GOSUB 3180 :GOTO 100
02370 GOSUB 3000:PRINT CHR$(12)
02380 PRINT "Examine the Next `";V$;"' Record?  ";:INPUT "";X$
02390 IF X$="Y"GOTO 2360
02400 IF X$<>"N"GOTO 2370
02410 GOTO 100
02420 :
02430 REM     STATUS SEARCH
02440 N3$="STATUS"
02450 GOSUB 2850
02460 FOR X=1TO V
02470 W$="SY1:"+A$(X)
02480 GOSUB 3040
02490 IF V$=B$THEN GOSUB 660 :IF L7=0 GOTO 2510
02500 NEXT X:GOSUB 3180 :GOTO 100
02510 GOSUB 3000 :PRINT CHR$(12)
02520 PRINT "Examine the Next `";V$;"' Record?  ";:INPUT "";X$
02530 IF X$="Y"GOTO 2500
02540 IF X$<>"N"GOTO 2510
02550 GOTO 100
02560 :
02570 REM     SINGLE STEP
02580 N3$="STARTING JOB#"
02590 GOSUB 2850
02600 IF V$=""THEN V$=A$(1)
02610 IF LEFT$(V$,1)<>"M"THEN V$="M"+V$
02620 IF MID$(V$,6,1)<>"P"THEN V$=V$+"P1"
02630 FOR X=1TO V
02640 IF V$=A$(X)GOTO 2710
02650 NEXT X
02660 GOSUB 3180
02670 GOTO 100
02680 :
02690 X=X+1
02700 IF X>V THEN GOSUB 3180:GOTO 100
02710 REM     FOUND RECORD/NOW READ
02720 W$="SY1:"+A$(X)
02730 GOSUB 3040
02740 GOSUB 660
02750 IF L7=1GOTO 2690
02760 GOSUB 3000:PRINT CHR$(12)
02770 LINE INPUT "Examine Next Record? <yes>  ";X$
02780 IF X$=""OR X$="Y"GOTO 2690
02790 IF X$<>"N"GOTO 2770
02800 GOTO 100
02810 :
02820 :
02830 REM     SUBROUTINES
02840 REM
02850 REM     SEARCH ROUTINE
02860 L7=0
02870 R3=99
02880 GOSUB 3000
02890 PRINT :PRINT :PRINT
02900 PRINT "Enter ";N3$;" to be Searched:  ";
02910 LINE INPUT "";V$
02920 PRINT :PRINT :PRINT
02930 LINE INPUT "Continual Listing?  ";X$
02940 IF X$="Y"THEN L7=1:GOSUB 3000:PRINT CHR$(12)
02950 IF X$="Y"THEN PRINT TAB(22)"CNTRL B -- ABORTS FURTHER SEARCHING":PAUSE 600
:GOTO 2970
02960 IF X$<>"N"GOTO 2920
02970 RETURN
02980 :
02990 REM     CLEAR SCREEN
03000 PRINT CHR$(27);CHR$(69)
03010 RETURN
03020 :
03030 REM     READ 1 RECORD
03040 OPEN W$ FOR READ AS FILE #3
03050 LINE INPUT #3,;A$:LINE INPUT #3,;B$:LINE INPUT #3,;C$:LINE INPUT #3,;D$
03060 LINE INPUT #3,;E$:LINE INPUT #3,;F$:LINE INPUT #3,;G$:LINE INPUT #3,;H$
03070 INPUT #3,;I:LINE INPUT #3,;J1$:LINE INPUT #3,;J2$:LINE INPUT #3,;J3$
03080 LINE INPUT #3,;J4$:LINE INPUT #3,;J5$:LINE INPUT #3,;J6$
03090 LINE INPUT #3,;J7$:LINE INPUT #3,;K1$:LINE INPUT #3,;K2$
03100 LINE INPUT #3,;K3$:LINE INPUT #3,;K4$:LINE INPUT #3,;K5$
03110 LINE INPUT #3,;K6$:LINE INPUT #3,;K7$:LINE INPUT #3,;K$
03120 LINE INPUT #3,;L$:LINE INPUT #3,;M$:LINE INPUT #3,;N$
03130 LINE INPUT #3,;O$
03140 CLOSE #3
03150 RETURN
03160 :
03170 REM     OUT OF DATA
03180 GOSUB 3000:PRINT CHR$(12)
03190 PRINT TAB(30);"                "
03200 PRINT TAB(30);"  END OF DATA  "
03210 PRINT TAB(30);"                "
03220 CLOSE #2
```

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Listing 3 continued.

```
03230 PRINT "<CR>";:PAUSE
03240 RETURN
03250 :
03260 REM     DRAW BORDERS
03270 IF M5=1 THEN FOR S2=1TO 79:PRINT #2,"=";:NEXT :PRINT #2,:RETURN
03280 PRINT #2,CHR$(27);CHR$(70);
03290 FOR S2=1TO 78:PRINT #2,"a";:NEXT
03300 PRINT #2,CHR$(27);CHR$(71);
03310 PRINT #2,
03320 RETURN
03330 :
03340 REM     CNTRL B -- ABORT CONT. LIST
03350 L7=0
03360 IF R3=99 THEN X=V
03370 W5=10
03380 PRINT :PRINT :PRINT TAB(30)"SEARCHING ABORTED!"
03390 RETURN
03400 :
03410 REM     MONEY FORMATER
03420 G6$=STR$(INT(100*G))
03430 L6=LEN(G6$)-2
03440 G6$=MID$(G6$,2,L6-2)+"."+MID$(G6$,L6,2)
03460 RETURN
03470 :
03480 END
```

Listing 4. Update program.

```
00010 REM     ******* UPDATE.LOG *******
00020 REM
00030 REM            Ray Massa
00040 REM             Version 7.0
00050 REM       Function #3 of Datalog
00060 REM
00070 REM     *************************
00080 REM
00090 R3=0
00100 X=0
00110 GOSUB 2560
00120 PRINT :PRINT :PRINT
00130 LINE INPUT "Enter Job# of Record You Wish to Modify:  ";V$
00140 IF VAL(V$)<VAL(J$)THEN PRINT :PRINT "===INVALID JOB#===":PRINT :GOTO 130
00150 IF LEFT$(V$,1)<>"M"THEN V$="M"+V$
00160 IF MID$(V$,6,1)<>"P"THEN V$=V$+"P1"
00170 W5=VAL(RIGHT$(V$,1))
00180 IF W5=0THEN W5=1
00190 W$="SY1:"+V$
00200 :
00210 REM     VERIFY JOB# IN INDEX
00220 FOR Y8=1TO V
00230 IF V$=A$(Y8)GOTO 290
00240 NEXT Y8
00250 PRINT CHR$(12)
00260 PRINT :PRINT TAB(21)"JOB# ";V$;" NOT FOUND ON THIS DISK."
00270 PRINT :PRINT "<CR>";:PAUSE
00280 GOTO 330
00290 W$="SY1:"+V$
00300 GOSUB 3190
00310 GOTO 450
00320 :
00330 GOSUB 2560
00340 PRINT :PRINT :PRINT
00350 PRINT TAB(30)"1 -- UPDATE JOB"
00360 PRINT TAB(30)"2 -- EXIT"
00370 PRINT :PRINT TAB(25);:LINE INPUT " Enter:  < 1 > ";X$
00380 IF X$="1"OR X$=""GOTO 10
00390 IF X$<>"2"GOTO 370
00400 GOSUB 2770
00410 CHAIN "HEADER.LOG",880
00420 :
00430 :
00440 REM     OPTION LIST
00450 GOSUB 2560
00460 PRINT "Job# ";RIGHT$(A$,6)
00470 PRINT C$
00480 PRINT
00490 IF R8(Y8)>1THEN PRINT "This Record Has ";R8(Y8);" Page(s)"
00500 PRINT :PRINT :PRINT
00510 PRINT TAB(15)"1.....STATUS"TAB(45)"6.....SALESMAN'S NAME"
00520 PRINT
00530 PRINT TAB(15)"2.....TITLE OF JOB"TAB(45)"7.....DESCRIPTION/CLIENT #"
00540 PRINT
00550 PRINT TAB(15)"3.....CATEGORY"TAB(45)"8.....WORK RECORD"
00560 PRINT
00570 PRINT TAB(15)"4.....DATE OF ENTRY"TAB(45)"9.....ADVANCE PAGE"
00580 PRINT
00590 PRINT TAB(15)"5.....PHOTOSTATS"TAB(45)"10....NEXT UPDATE"
00600 PRINT :PRINT TAB(32)"11.....EXIT"
00610 PRINT :PRINT
00620 LINE INPUT "  Enter Type of Update:   ";X$
00630 PRINT :PRINT
00640 GOSUB 2560
00650 ON VAL(X$)GOTO 770,830,890,940,1960,1000,1050,1170,680,720,740
00660 GOTO 450
00670 :
00680 GOSUB 2600:GOSUB 3010
00690 IF R3=99GOTO 330
00700 GOTO 450
00710 REM
00720 GOSUB 2600:GOTO 10
00730 REM
00740 GOSUB 2600:GOSUB 2770:CHAIN "HEADER.LOG",880
00750 :
00760 :
00770 PRINT "CURRENT STATUS: "B$
```

More

command when single-stepping.

This option would be used the most when data is being output to a printer. In this way it will print out all desired records on a disk without further commands from you once the initial parameters have been set.

If you have selected a continual list and no longer wish to view or print the remaining records that may still exist, you can cancel this option while the program is running. Just depress the CNTRL key and hit the letter B at the same time. After the job in progress is finished, you will have the option of continuing or returning to the menu. The messsage SEARCHING ABORTED! will be displayed on the video terminal when CNTRL B is struck.

Update Data

Any data that has been entered may now be altered or additional information added to it (see Listing 4). Enter the desired job number, and the program will search the disk. If found, it will display the title and job number in the upper-left corner of the screen, along with the available categories you may change or update. These are: status, title, category, date, photostats, exit, salesman's name, description/client number, work record, advance page and next update.

When changing the contents of one of the categories, the original entry will be displayed along with a prompt for you to enter the new data.

You may add to the work record of a job quite easily. If less than 14 lines are used for that page, then you can add more lines. Or you can change or delete any of the existing lines. Delete a line by typing a carriage return in response to the three prompts. Note that although the contents of the line are deleted, the physical line is still contained on the record.

If the photostat section is to be updated, the program will display for each size category the current entries on the record. You can then add to or delete the entire contents of a specific size photostat.

In both the update and examine data options, entering a four-digit job number to be searched automatically results in the program searching for page 1. On the disk catalog this appears as MxxxxP1. If you type in a four-digit number followed by the letter P and a numeral 1 to 9 to indicate the page number, then Datalog will search only for that specific page.



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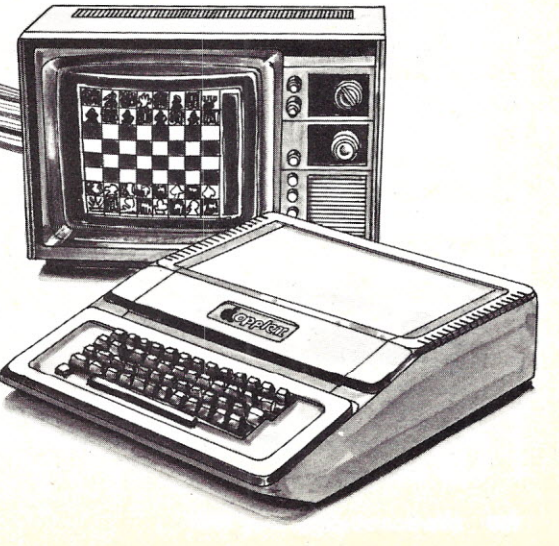
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Listing 4 continued.

```
00780 PRINT :PRINT TAB(10);
00790 LINE INPUT " Enter New Status:   ";B$
00800 B$(YB)=B$
00810 GOTO 450
00820 :
00830 PRINT "CURRENT TITLE: "C$
00840 PRINT :PRINT TAB(10);
00850 LINE INPUT " Enter New Title:   ";C$
00860 C$(YB)=C$
00870 GOTO 450
00880 :
00890 PRINT "CURRENT CATEGORY: "D$
00900 PRINT :PRINT TAB(10);
00910 LINE INPUT " Enter New Catesory:   ";D$
00920 PRINT :GOTO 450
00930 :
00940 PRINT "CURRENT DATE OF ENTRY: ";E$
00950 PRINT :PRINT TAB(10);
00960 LINE INPUT " Enter New Date:   ";E$
00970 E$(YB)=E$
00980 GOTO 450
00990 :
01000 PRINT "CURRENT SALESMAN NAME: ";F$
01010 PRINT :PRINT TAB(10);
01020 LINE INPUT " Enter New Name:   ";F$
01030 GOTO 450
01040 :
01050 PRINT "CURRENT DESCRIPTION IS: "G$
01060 PRINT TAB(12)"CLIENT JOB#: ";H$
01070 PRINT TAB(75)"K"
01080 PRINT :PRINT TAB(10);
01090 LINE INPUT " Enter New Description:   ";G$
01100 IF LEN(G$)>40THEN PRINT :PRINT "New Line is too Long":GOTO 1080
01110 PRINT :PRINT :PRINT TAB(10);
01120 LINE INPUT " Enter New Client Job#:   ";H$
01130 GOTO 450
01140 :
01150 :
01160 :
01170 PRINT :PRINT :PRINT
01180 PRINT TAB(30)"A---Add"
01190 PRINT TAB(30)"C---Change"
01200 PRINT TAB(30)"Q---Quit"
01210 PRINT :PRINT TAB(24);:LINE INPUT " Enter:   ";Z2$
01220 IF I=0THEN PRINT :PRINT "NO TEXT EXISTS FOR THIS RECORD.":PAUSE 600
01230 IF Z2$="Q"GOTO 450
01240 IF Z2$="A"AND I=14AND R8(YB)>1THEN PRINT :PRINT "ADVANCE TO NEXT PAGE":GO
TO 1260
01250 GOTO 1270
01260 PRINT ", TO ADD ANOTHER LINE OF INFORMATION.":PRINT :PRINT "<CR>";:PAUSE :
GOTO 450
01270 IF Z2$="A"AND I=14THEN PRINT :PRINT "*** END OF PAGE ***":PAUSE 1300:GOTO
450
01280 IF Z2$="A"THEN I=I+1 :X=I :GOTO 1360
01290 IF Z2$<>"C"GOTO 1170
01300 GOSUB 2560
01310 PRINT :PRINT :PRINT
01320 PRINT " Change What Line?  (1 to";I")  ";:LINE INPUT "";X$
01330 IF I=0THEN I=1
01340 X=VAL(X$):IF X<1OR X>I GOTO 1300
01350 IF X>11GOTO 1370
01360 ON X GOTO 1380,1390,1400,1410,1420,1430,1440,1450,1460,1470,1480
01370 ON LNO(15-X)GOTO 1510,1500,1490
01380 X$=J1$:GOSUB 1550:J1$=X$:GOTO 1520
01390 X$=J2$:GOSUB 1550:J2$=X$:GOTO 1520
01400 X$=J3$:GOSUB 1550:J3$=X$:GOTO 1520
01410 X$=J4$:GOSUB 1550:J4$=X$:GOTO 1520
01420 X$=J5$:GOSUB 1550:J5$=X$:GOTO 1520
01430 X$=J6$:GOSUB 1550:J6$=X$:GOTO 1520
01440 X$=J7$:GOSUB 1550:J7$=X$:GOTO 1520
01450 X$=K1$:GOSUB 1550:K1$=X$:GOTO 1520
01460 X$=K2$:GOSUB 1550:K2$=X$:GOTO 1520
01470 X$=K3$:GOSUB 1550:K3$=X$:GOTO 1520
01480 X$=K4$:GOSUB 1550:K4$=X$:GOTO 1520
01490 X$=K5$:GOSUB 1550:K5$=X$:GOTO 1520
01500 X$=K6$:GOSUB 1550:K6$=X$:GOTO 1520
01510 X$=K7$:GOSUB 1550:K7$=X$:GOTO 1520
01520 PRINT
01530 GOTO 1170
01540 :
01550 GOSUB 2560
01560 PRINT :PRINT
01570 IF Z2$="A"THEN PRINT "Line# "X :GOTO 1590
01580 PRINT "Current Information on Line ";X;" Reads as Follows:"
01590 PRINT
01600 PRINT TAB(10)X$
01610 :
01620 GOSUB 2930
01630 PRINT :PRINT
01640 PRINT "Faaaaaaaaaaaaaaaaaaaaaaaaasaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaac"
01650 PRINT "`"TAB(27)"`"TAB(80)"`"
01660 PRINT "` WORK RECORD DATE:      `
      `"
01670 PRINT "`"TAB(27)"`"TAB(80)"`"
01680 PRINT "` WORK THAT WAS DONE:    `
      `"
01690 PRINT "`"TAB(27)"`"TAB(80)"`"
01700 PRINT "` NUMBER OF HOURS:       `
      `"
01710 PRINT "`"TAB(27)"`"TAB(80)"`"
01720 PRINT "eaaaaaaaaaaaaaaaaaaaaaaauaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaaad"
01730 GOSUB 2970
01740 L3=8
01750 GOSUB 2860:LINE INPUT "";P$
01760 GOSUB 2860:LINE INPUT "";G$
01770 REM     CHECK FOR OVERFLOW
01780 IF LEN(G$)>50THEN L3=10:GOSUB 2860:PRINT CHR$(27);"K":L3=10:GOSUB 2860:GOT
O 1800
01790 GOTO 1820
```

More

The advance page option simply searches for any additional pages for the job number you are currently updating. It is advanced in a sequential manner with the next highest page number being searched for. If found, normal updating procedures follow. This can be repeated for as many pages as exist for that job number. If no other pages are found, then an OUT OF DATA message is displayed.

Selecting NEXT UPDATE writes the current revised job back to the disk file and deletes the old one at the same time. It then asks for the next job number to be updated.

EXIT also writes the updated job back to the disk and then chains to the header.log and displays the menu.

View Index

This will display on the video terminal a complete summarized listing of all jobs entered on a disk. The following is the information that is shown on the index for each page of a job.

TITLE
JOB #
TOTAL PAGES
ENTRY DATE
STATUS

The index displays ten pages of jobs at a time on the video terminal. Hit return to display the next ten.

Print Index

This is identical to View Index except that output is directed to your printer. You do not need to advance each of the ten jobs; it will automatically print the entire index without stopping.

This simply exits the Datalog program in an orderly fashion and reminds you to make a new copy of your back-up disk.

Conclusion

The code for DataLog.Bas is a bit complex, but because of its self-prompting structure, operating the program is quite easy. The program can be changed to a nonbusiness structure by removing all references to job numbers and replacing them with record numbers. Also, the photostat section can be eliminated if not needed. The included sample printout (Listing 5) should give you some ideas for nonbusiness uses.

Readers who prefer not to type in the code can send me $10 for a copy of DataLog on a 5-1/4 inch disk, with documentation. ■

Listing 4 continued.

```
01800 PRINT " ENTRY TOO LONG! ::: RE-ENTER                    `":L3=10
01810 GOSUB 2860:PAUSE 1000:FOR S2=1TO 34:PRINT " ";:NEXT :PRINT :L3=10:GOTO 176
0
01820 GOSUB 2860:LINE INPUT "";S$
01830 :
01840 :
01850 IF P$=""AND G$=""AND S$=""GOTO 1900
01860 PRINT :PRINT :PRINT
01870 PRINT :PRINT "NEW LINE#"X"NOW READS:"
01880 PRINT :PRINT P$"  "G$"  "S$
01890 X$=P$+"^"+G$+"^"+S$+"^":RETURN
01900 PRINT :PRINT
01910 IF Z2$="A"THEN PRINT :PRINT "  Line# ";I;" Deleted  ":I=I-1:RETURN
01920 PRINT :PRINT "  Line# ";X;" Deleted  ":X$="^ ^ ^":RETURN
01930 :
01940 :
01950 REM      PHOTOSTAT ROUTINE
01960 K=0
01970 GOSUB 2560
01980 PRINT TAB(15)"When Thru, Type ..............`QUIT'"
01990 PRINT
02000 PRINT TAB(15)"Delete a Line, Type ...........`DEL'"
02010 PRINT
02020 PRINT TAB(15)"Advance Catesory, Hit .........`RETURN'"
02030 K=K+1:IF K=6GOTO 450
02040 I2=1
02050 IF K=1THEN X$="8X10":G$=K$
02060 IF K=2THEN X$="10X12":G$=L$
02070 IF K=3THEN X$="11X14":G$=M$
02080 IF K=4THEN X$="12X18":G$=N$
02090 IF K=5THEN X$="18X24":G$=O$
02100 PRINT :PRINT :PRINT X$" PHOTOSTATS"
02110 PRINT "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaa"
02120 PRINT
02130 X=44:IF LEN(G$)<45GOTO 2170
02140 M=MATCH(G$,"/",X)
02150 IF M>70OR M=LEN(G$)THEN G1$=LEFT$(G$,M):G2$=MID$(G$,M+1):M=0:GOTO 2180
02160 X=X+1:GOTO 2140
02170 PRINT :PRINT TAB(10)"CURRENT "X$" PHOTOSTATS: "G$:GOTO 2200
02180 PRINT :PRINT "CURRENT "X$" PHOTOSTATS: ":PRINT G1$:PRINT G2$
02190 :
02200 C4=0:M=1
02210 M=MATCH(G$,"/",M):IF LEN(G$)=M GOTO 2230
02220 C4=C4+1:M=M+1:GOTO 2210
02230 C1$(I2)="NULL"
02240 IF I2+C4>20THEN PRINT :PRINT "WARNING!--PLEASE CONDENSE ENTRY. (20 TOTAL)"
02250 PRINT
02260 :
02270 LINE INPUT " ADD h  ";C1$(I2)
02280 REM      CHECK FOR VALID ENTRY CODES
02290 IF LEFT$(C1$(I2),1)="G" OR C1$(I2)="" THEN GOSUB 2560:GOTO 2380
02300 IF C1$(I2)="DEL"THEN G$="":G1$="":G2$="":GOSUB 2450:GOTO 1970
02310 READ R2$
02320 DATA LN,SC,RV,CP,CN,BL,K1,K2,K3,ZZ
02330 IF R2$="ZZ"THEN RESTORE :PRINT :PRINT "===INVALID CODE ENTRY===":GOTO 2240
02340 IF RIGHT$(C1$(I2),2)=R2$ THEN RESTORE :GOTO 2370
02350 GOTO 2310
02360 :
02370 I2=I2+1:GOTO 2240
02380 IF I2=1GOTO 2410
02390 FOR D=1TO (I2-1)
02400 G$=G$+C1$(D)+"/":NEXT
02410 IF LEFT$(C1$(I2),1)="G"THEN GOSUB 2450 :GOTO 450
02420 GOSUB 2450
02430 IF K=5 GOTO 450
02440 GOTO 2030
02450 IF K=1THEN K$=G$
02460 IF K=2THEN L$=G$
02470 IF K=3THEN M$=G$
02480 IF K=4THEN N$=G$
02490 IF K=5THEN O$=G$
02500 RETURN
02510 :
02520 :
02530 REM      SUBROUTINES
02540 REM
02550 REM      CLEAR SCREEN
02560 PRINT CHR$(27);CHR$(69)
02570 RETURN
02580 :
02590 :
02600 REM      WRITE UPDATED RECORD BACK TO DISK
02610 REM
02620 OPEN W$ FOR WRITE AS FILE #3
02630 PRINT #3,A$:PRINT #3,B$:PRINT #3,C$:PRINT #3,D$:PRINT #3,E$
02640 PRINT #3,F$:PRINT #3,G$:PRINT #3,H$:PRINT #3,I:PRINT #3,J1$:PRINT #3,J2$
02650 PRINT #3,J3$:PRINT #3,J4$:PRINT #3,J5$:PRINT #3,J6$:PRINT #3,J7$
02660 PRINT #3,K1$:PRINT #3,K2$:PRINT #3,K3$:PRINT #3,K4$:PRINT #3,K5$
02670 PRINT #3,K6$:PRINT #3,K7$:PRINT #3,K$:PRINT #3,L$:PRINT #3,M$
02680 PRINT #3,N$:PRINT #3,O$
02690 CLOSE #3
02700 OPEN Z$ FOR WRITE AS FILE #1
02710 PRINT #1,Z$:PRINT #1,D3$:PRINT #1,E:PRINT #1,J$:PRINT #1,A9$
02720 PRINT #1,Y$:PRINT #1,V
02730 CLOSE #1:RETURN
02740 :
02750 :

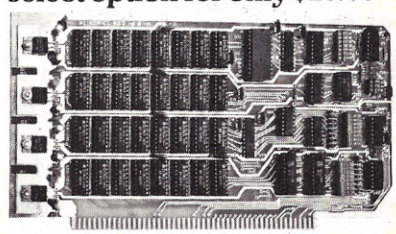
02760 REM      UPDATE HEADER FILE
02770 OPEN I$FOR WRITE AS FILE #1
02780 FOR Y8=1TO V
02790 PRINT #1,C$(Y8):PRINT #1,A$(Y8):PRINT #1,R8(Y8)
02800 PRINT #1,E$(Y8):PRINT #1,B$(Y8)
02810 NEXT Y8
02820 CLOSE #1
02830 RETURN
02840 :
02850 :
02860 REM      CURSOR ADDRESSING      ( Ln          Col )
02870 L3=L3+2
```

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Listing 4 continued.

```
02880 C=26
02890 PRINT CHR$(27);CHR$(89);CHR$(32+L3);CHR$(32+C);
02900 RETURN
02910 :
02920 :
02930 REM     CURSOR OFF/ON
02940 PRINT CHR$(27);CHR$(120);CHR$(53);
02950 RETURN
02960 REM
02970 PRINT CHR$(27);CHR$(121);CHR$(53);
02980 RETURN
02990 :
03000 :
03010 REM     ADVANCE PAGE
03020 IF VAL(RIGHT$(W$,1))<R8(Y8)GOTO 3130
03030 GOSUB 2560
03040 PRINT CHR$(12)
03050 PRINT TAB(28)"                                "
03060 PRINT
03070 PRINT TAB(28)"NO ADDITIONAL PAGES FOUND"
03080 PRINT
03090 PRINT TAB(28)"                                "
03100 R3=99
03110 PRINT :PRINT "<CR>"::PAUSE :RETURN
03120 REM
03130 W5=W5+1
03140 W$="SY1:"+LEFT$(V$,6)+MID$(STR$(W5),2,1)
03150 GOSUB 3190
03160 RETURN
03170 :
03180 :
03190 REM     READ DATA
03200 OPEN W$ FOR READ AS FILE #2
03210 LINE INPUT #2,;A$:LINE INPUT #2,;B$:LINE INPUT #2,;C$:LINE INPUT #2,;D$
03220 LINE INPUT #2,;E$:LINE INPUT #2,;F$:LINE INPUT #2,;G$:LINE INPUT #2,;H$
03230 INPUT #2,;I:LINE INPUT #2,;J1$:LINE INPUT #2,;J2$:LINE INPUT #2,;J3$
03240 LINE INPUT #2,;J4$:LINE INPUT #2,;J5$:LINE INPUT #2,;J6$
03250 LINE INPUT #2,;J7$:LINE INPUT #2,;K1$:LINE INPUT #2,;K2$
03260 LINE INPUT #2,;K3$:LINE INPUT #2,;K4$:LINE INPUT #2,;K5$
03270 LINE INPUT #2,;K6$:LINE INPUT #2,;K7$:LINE INPUT #2,;K$
03280 LINE INPUT #2,;L$:LINE INPUT #2,;M$:LINE INPUT #2,;N$:LINE INPUT #2,;O$
03290 CLOSE #2
03300 RETURN
03310 :
03320 REM     END
```

Listing 5. Datalog program sample run.

```
JOB # 1234P1 /STATUS      SAMPLE TITLE (Max. 35 characters)          CATEGORY
Feb.18, 1980                                                      SALESMAN NAME
                    THIS IS DESCRIPTION FIELD (max. 40 char)
                                CLIENT JOB #

=============================================================================

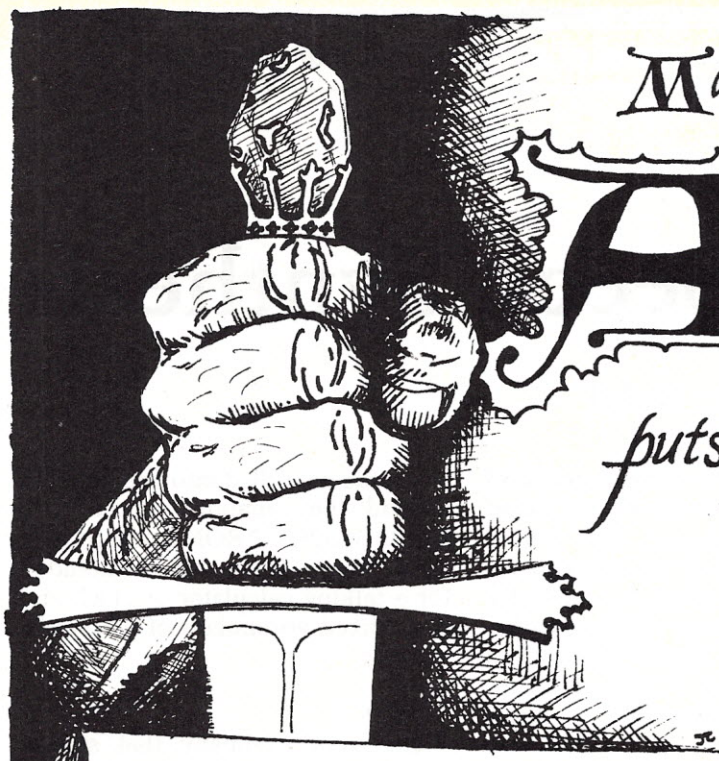
2-17-80    This is Line #1 of the TEXT FIELD.  (Max. 50 char.)     | 123456
2-18-80    This is Line #2 of Text. There is a maximum of          |
           14 lines per page for any record. But each record       |
           may have a total of up to 9 pages. If additional        |
           space is required for a record (more than 126           |
           lines) then you may start another record number         |
           and continue on. There is no limit to this feature      |
           as long as disk space is still available.               |
                                                                   |
2-23-80    It is not necessary to enter a date or a numeric        | 000000
           entry. You may skip entire lines by entering all        |
           carraige returns. The numeric entries will be           |
           summed at the bottom of each page, unless the           |
           value is zero. This is the 14th and last line.          | 123.45

=============================================================================
                                                TOTAL AMOUNT    $ 123579
```

```
      SAMPLE INDEX                                              Disk # 1

Title                                    Job #      Pages      Date          Status
=============================================================================

SAMPLE TITLE  (Max. 35 characters)      1001P1       1      Feb.10, 1980     STATUS
SCIENTIFIC EQUATIONS                    1001P1       2      Feb.19, 1980     STATUS
SCIENTIFIC EQUATIONS CONT. (Page 2)     1001P2       2      Feb.19, 1980     STATUS
ASTRONOMY FACTS                         1002P1       1      Feb.22, 1980     STATUS
MICRO-COMPUTING GLOSSARY                1003P1       1      Feb.23, 1980     STATUS
FAVORITE RECIPES                        1004P1       2      Feb.27, 1980     STATUS
AUTO MAINTENANCE SCHEDULE               1005P1       1      Feb.28, 1980     STATUS
HEATH COMPUTER BUGS                     1006P1       1      Mar.04, 1980     STATUS
PHOTOGRAPHY NOTES                       1007P1       1      Mar.16, 1980     STATUS
CHEMISTRY                               1008P1       1      Mar.20, 1980     STATUS
```



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Advances in Speech Synthesis

By Larry Nickel

Until recently, speech synthesis was either costly, complicated or cumbersome. The methods of the past were either tape recorders or the use of huge memories to store conventionally digitized speech. Now the technology of large-scale integration (LSI) and very large-scale integration (VLSI), coupled with extensive research into the mechanics of speech, have allowed construction of solid-state speech synthesizers with only a few ICs.

Various Approaches

The tape recorder method was one of the first approaches. It allows storage of many words, but the maximum access time for each word can be very long. The mechanical aspects of this system are not particularly reliable either.

The brute-force approach uses an eight-bit analog-to-digital converter with a clock rate of perhaps eight to ten kHz. The speech data is then stored in ROM (read only memory). For playback a digital-to-analog converter is used. Unfortunately, 100,000 bits per second would require an enormous memory just for ten or 15 words. Instead of using ROM, RAM (random access memory) could be used, with the vocabulary stored on disk and loaded as required. This could impose a great deal of wear on the disk system if the device must speak often.

Some years ago linguists developed a set of sounds called phonemes, which could be strung together to form words. Generally, you have to determine the phonemes needed for the particular words that you want to speak. This can be complicated, and sometimes the words do not sound exactly as you expect. The advantages are that only a few bytes are required for each word, and virtually any word or sound can be synthesized. Phoneme word synthesizers have been priced at $225 and up. (One supplier is included in reference 1.)

Larry Nickel (211 Sacred Heart Lane, Reisterstown, MD 21136) has published articles in 73 Magazine, Electronics World, Ham Radio *and other magazines.*

New Product Advances

A number of companies (mostly semiconductor firms) have recently announced voice synthesizer ICs. Usually, the manufacturer provides a ROM with speech data, and this ROM attaches to the synthesizer chip. The speech data contains complex pitch and amplitude information which is processed by the synthesizer. It is not possible for the customer to generate the data that goes into the ROM. The semiconductor manufacturer records the human voice and uses sophisticated algorithms and some human intervention to arrive at the ROM code. The user must either be content with standard vocabularies that are offered or pay huge development costs for custom words.

The good news is that inexpensive standard vocabularies are being developed now, and several will be available at the time of this printing. Industry is looking forward to using this technology for clocks, appliances, test instruments, automobiles, scales, gasoline pumps and telephones. Within the next six months these voice synthesizers will be sold (in huge quantities) for less than $10, and many new electronic products will be talking.

General Instrument

General Instrument (see reference 2) has several interesting products. The SP0256 is a synthesizer, microprocessor and enough ROM for about 16 words, all rolled into one chip. To expand the capability, an SPR16, SPR32 or SPR128 ROM is added. The VSM2032 is a three-chip set intended for a talking calculator or clock and has a fixed vocabulary of 37 words/phrases.

Votrax

The same company that started with phoneme synthesizers years ago is now offering some new products. Votrax (see reference 1) has an SC01 speech synthesizer IC, an SC01 speech pack which says 255 words/phrases and an SC01 evaluation board which includes about 1000 words/phrases, plus sound effects. Evidently some of this technology is included in a new portable product for the handicapped speechless person called the "Phonic Mirror Handy Voice."

Texas Instruments

Texas Instruments has two new voice synthesis ICs, using what TI refers to as linear predictive coding. A time-varying digital filter models the voice tract, and this filter is excited with "a digital representation of either glottal air impulses (voiced sounds) or the rush of air (unvoiced sounds)."

The bottom line is that getting from voice to ROM code is a very complex process. The TMS5100 is a four-bit device including an on-chip 36 mW power amplifier and is intended for low-cost, high-volume applications. The TMS5200 is an eight-bit device and is for microprocessor and bus-oriented uses; it features slightly higher quality speech than the 5100 (but requires a low pass filter and amplifier). The 5200 has a READY line and must be treated as a slow memory device by inserting appropriate wait states.

Both the 5100 and 5200 use the

Texas Instruments TMS6100 128K-bit ROM which stores the speech data. A demonstration vocabulary is available, but don't buy it because it contains such phrases as "Leon thinks it abnormal for a giraffe to roll on the ground." The product of most interest is a standard vocabulary being offered with approximately 200 words and is designated the VM61001.

The custom linear predictive coding speech is very good quality. Additionally, TI is able to generate phonemes. One company, Street Electronics Corporation (see reference 3), is already marketing a phoneme generator based on the TMS5200.

TI also has a technique using allophones. Allophones sound a lot like the Cylon warriors from Battlestar Gallactica—kind of a monotone but understandable. The phoneme or allophone approach allows the speech data to be much more compact.

Before you invest in TI's technology, drop them a note and request literature on the TMS5100, 5200 and 6100 (see reference 4). Also inquire about their speech synthesis chip set, the TMSK201. Evidently the TMSK201 is available with the VM61001 standard vocabulary (but be sure you don't get the demo vocabulary).

National Semiconductor

National Semiconductor has recently introduced Digitalker, their speech synthesis chip, the MM54104. Like the TI TMS5200, the MM54104 requires a ROM for storage. National makes a pair of ROMs designated MM52164-SSR1 and MM52164-SSR2, which are packaged with the MM54104 in a product called the DT1050 Standard Vocabulary Kit. The kit costs $85, and the price trend should be down. Regardless, most of the other manufacturers are pricing their products somewhat higher than Digitalker. The ROMs contain 143 letters/numbers and words (see Table 1). I can think of a lot of other words that I would like to have, but these 143 let you do a great deal. Additional standard vocabularies will be available soon. Also, see my software tips below.

Hardware Tips

National doesn't have a fancy name for their digital word encoding technique, but the speech produced is high quality. The hardware interface to a microprocessor is simple. You simply treat the synthesizer just as you would a location in I/O or RAM. Use the CS (chip select) line and the WR (write) lines, which are active low. The MM54104 produces an INTR (interrupt) output when it is finished voicing each word. This can signal your processor to jam in the next word. The CMS (command select) line can be kept low, or, if you would like to reset the INTR line without initiating the next speech word, lift CMS high and perform a WRITE.

If you can easily control the time between words, the INTR line may not be needed. It does help to produce uniform word spacing if INTR is used. To conserve power a ROM enable (ROMEM) pin is provided to shut off the ROM when it is not in use.

The speech output from the

WORD/PHRASE/LETTER	HEX	DECIMAL
THIS IS DIGITALKER	00	0
ONE	01	1
TWO	02	2
THREE	03	3
FOUR	04	4
FIVE	05	5
SIX	06	6
SEVEN	07	7
EIGHT	08	8
NINE	09	9
TEN	0A	10
ELEVEN	0B	11
TWELVE	0C	12
THIRTEEN	0D	13
FOURTEEN	0E	14
FIFTEEN	0F	15
SIXTEEN	10	16
SEVENTEEN	11	17
EIGHTEEN	12	18
NINETEEN	13	19
TWENTY	14	20
THIRTY	15	21
FORTY	16	22
FIFTY	17	23
SIXTY	18	24
SEVENTY	19	25
EIGHTY	1A	26
NINETY	1B	27
HUNDRED	1C	28
THOUSAND	1D	29
MILLION	1E	30
ZERO	1F	31
A	20	32
B	21	33
C	22	34
D	23	35
E	24	36
F	25	37
G	26	38
H	27	39
I	28	40
J	29	41
K	3A	42
L	3B	43
M	3C	44
N	3D	45
O	3E	46
P	3F	47
Q	40	48
R	41	49
S	42	50
T	43	51
U	44	52
V	45	53
W	46	54
X	47	55
Y	48	56
Z	49	57
AGAIN	5A	58
AMPERE	5B	59
AND	5C	60
AT	5D	61
CANCEL	5E	62
CASE	5F	63
CENT	60	64
400 HERTZ TONE	61	65
80 HERTZ TONE	62	66
20MS SILENCE	63	67
40MS SILENCE	64	68
80MS SILENCE	65	69
160MS SILENCE	66	70
320MS SILENCE	67	71
CENTI	68	72
CHECK	69	73
COMMA	6A	74
CONTROL	6B	75
DANGER	6C	76
DEGREE	6D	77
DOLLAR	6E	78
DOWN	6F	79
EQUAL	70	80
ERROR	71	81
FEET	72	82
FLOW	73	83
FUEL	74	84
GALLON	75	85
GO	76	86
GRAM	77	87
GREAT	78	88
GREATER	79	89
HAVE	7A	90
HIGH	7B	91
HIGHER	7C	92
HOUR	7D	93
IN	7E	94
INCHES	7F	95
IS	80	96
IT	81	97
KILO	82	98
LEFT	83	99
LESS	84	100
LESSER	85	101
LIMIT	86	102
LOW	87	103
LOWER	88	104
MARK	89	105
METER	8A	106
MILE	8B	107
MILLI	8C	108
MINUS	8D	109
MINUTE	8E	110
NEAR	8F	111
NUMBER	9A	112
OF	9B	113
OFF	9C	114
ON	9D	115
OUT	9E	116
OVER	9F	117
PARENTHESIS	A0	118
PERCENT	A1	119
PLEASE	A2	120
PLUS	A3	121
POINT	A4	122
POUND	A5	123
PULSES	A6	124
RATE	A7	125
RE	A8	126
READY	A9	127
RIGHT	AA	128
SS(PLURAL)	AB	129
SECOND	AC	130
SET	AD	131
SPACE	AE	132
SPEED	AF	133
STAR	B0	134
START	B1	135
STOP	B2	136
THAN	B3	137
THE	B4	138
TIME	B5	139
TRY	B6	140
UP	B7	141
VOLT	B8	142
WEIGHT	B9	143

Table 1. The Digitalker vocabulary.

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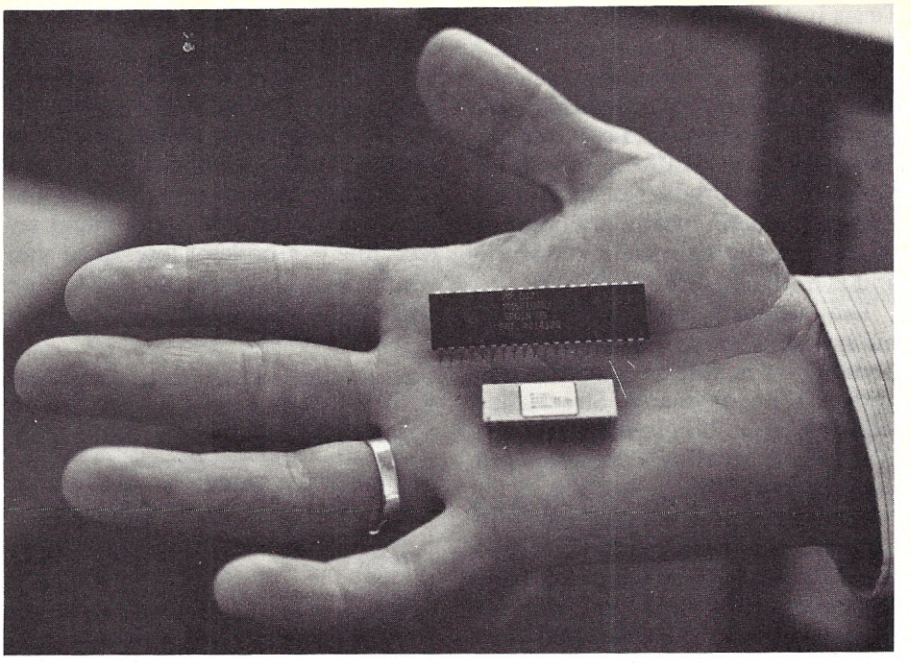
This incredible program was written by a professional software consultant to TRW Space Systems. This is a complex program carefully human factored for easy use. It is a comprehensive horse racing system for spotting overlays in thoroughbred sprint races. Your computer will accurately predict the win probability and odds line for each horse based on your entries from the racing form. The next day overlaid horses can be spotted on the track tote board. The user's manual contains a complete explanation of overlay betting plus much more useful information. The appendix contains a detailed tab run of a 100 consecutive race system workout showing **an amazing 50% return** ($1.50 returned for each $1.00 flat wager.) Includes many features such as error correction, bubble sort, line printer output, automatic keyboard debounce, archiving, etc. The manual may be ordered separately for perusal for $7.95 and credit.

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Digitalker chips. (Photo courtesy National Semiconductor)

MM54104 is buffered in a follower (gain of 1) stage. National recommends use of the programmable LM346 OPAMP, probably for low-power applications, but I substituted an LM741. The output of the OPAMP drives an LM386 power amplifier. More gain can be extracted from the LM386 if a 10 uF capacitor (or a cap in series with a resistor) is connected between pins 1 and 8. Be careful of the wiring layout if you do this, because otherwise there could be some oscillation due to the high gain.

I have connected this equipment to my TRS-80 Model I Level II, but it could run on virtually any system. The circuit of Fig. 1 is a good starting point. Fig. 2 shows the TRS-80 pinouts for the expansion bus at the keyboard and expansion interface. An expansion interface is not required. Be careful how you wire to the TRS-80. The edge connectors match the numbering, for instance, on Viking wire-wrap connector P/N 3VH20/1JND5 and many other edge connectors, except for flat cable insulation displacement types. These types are numbered differently.

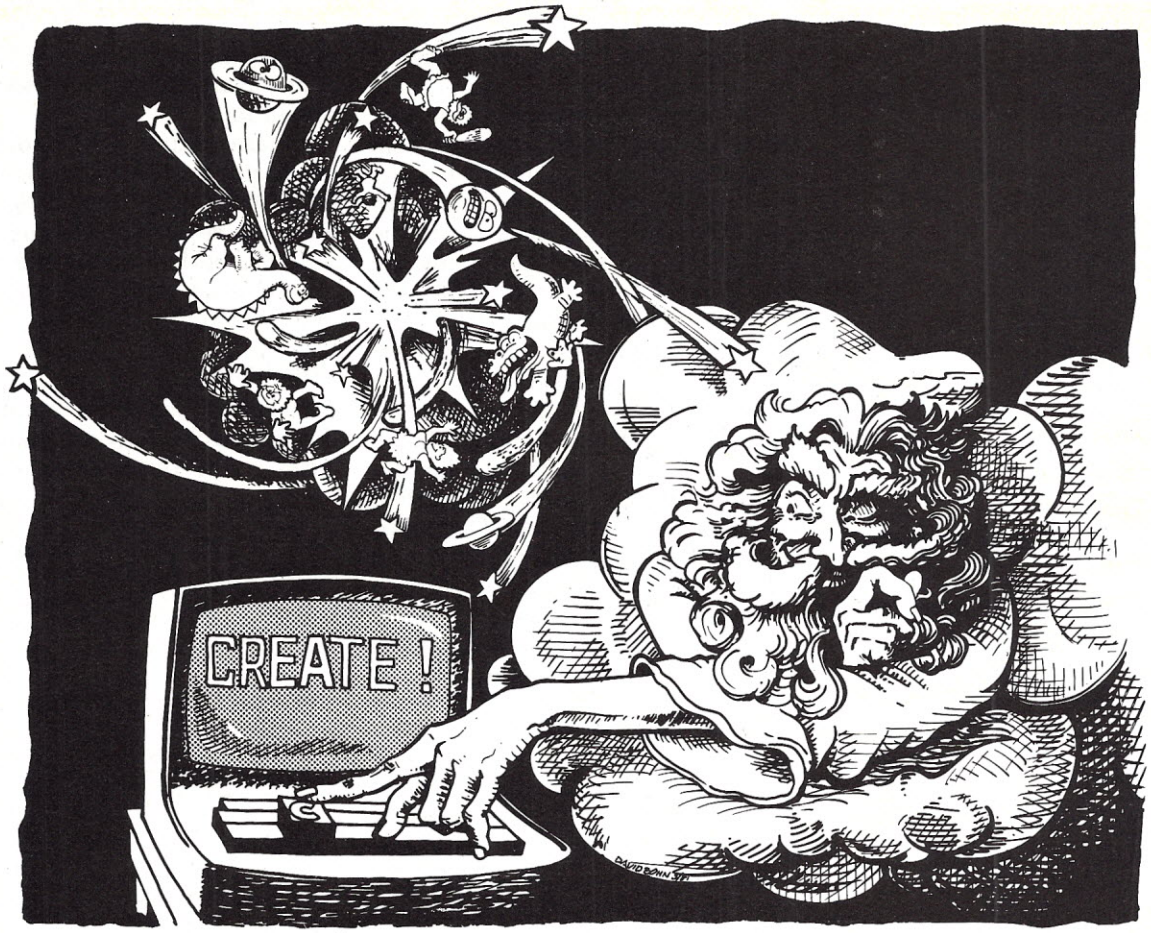
Note that in the schematic of Fig. 1 the MM54104 is I/O mapped and that an OUT instruction to location 0 will initiate speech and reset INTR. An OUT instruction to location 2 will only reset INTR. In BASIC, for instance, OUT 0,127 would sound the word "ready."

If you leave some extra space on the board when you fabricate this circuitry, you can add some sockets later for additional ROM. With a few TTL chips to manipulate the device selects for the MM52164s, more than two ROMs could be supported. Note that no bus drivers will be needed for the MM54104 regardless of the microprocessor system that it is used with, since there is no way or need to read data from the MM54104. Since the MM54154 is NMOS, it also does not load the bus appreciably. You should write or call National Semiconductor (see reference 5) for data sheets and application notes on the DT1050.

In wiring the DT1050, check and recheck your work with care. A mistake could prematurely destroy the ICs. National recommends using 7–11 V dc to power the MM54104 so the output of the LM78L05 has been adjusted to approximately 9 V dc. I suggest that all power supplies be checked before inserting the synthesizer or ROMs. As with any MOS device, be sure to avoid static discharges.

Software Tips

Any words or letters from the ROM can be chained together to make phrases or sentences. Not as obvious, pieces of words may be combined to make new words. For instance, if you start the word "comma" and jam in "pound" halfway through comma, you can get "compound." If you gate the audio buffer or amplifier, you could chop off the first part of a word



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```
10 'SYNTHESIZE ATTENTION
20 OUT12,58
30 D=50
40 GOSUB 180
50 OUT12,10
60 D=110
70 GOSUB 180
80 OUT12,73
90 D=20
100 GOSUB 180
110 OUT12,58
120 D=10:GOSUB180
130 OUT12,111
140 D=25:GOSUB180
150 OUT12,71
160 D=500:GOSUB180
170 GOTO 20
180 FOR X=1 TO D
190 NEXT X
200 RETURN
```

Listing 1. Synthesizing "attention."

```
10 'SYNTHESIZE COMPUTER
20 OUT12,74:          'COM FROM COMMA
30 D=30:GOSUB150
40 OUT12,124:         'P FROM PULSES
50 D=30:GOSUB150
60 OUT12,52:          'U
70 D=70:GOSUB150
80 OUT12,139:         'T FROM TIME
90 D=20:GOSUB150
100 OUT12,81:         'ER FROM ERROR
110 D=30:GOSUB150
120 OUT12,71:         'SILENCE
130 D=500:GOSUB150
140 GOTO 20
150 FOR X= 1 TO D
160 NEXT X
170 RETURN
```

Listing 2. Synthesizing "computer."

and use the last part. You can use letters as words such as "u" for "you" and "b" for "be," etc. I use "weight" for the word "wait."

A phoneme-based system would be better for creating your own custom words, but I have found that many new words can be synthesized with only the sounds and syllables in the DT1050. Some short programs are provided as food for thought. Remember that the timing is very critical when only pieces of words are used. If your computer is not a TRS-80, the timing will need to be altered slightly. If you have a TRS-80, then as a starting point type the programs in exactly as they are listed. Note that my Digitalker is I/O mapped as location 12. Change this to suit your system.

The first example (Listing 1) is for the word ATTENTION. The A from again (line 20) is followed by the TEN from the number 10 (line 50), followed by the CH from check (line 80), followed by the A from again (line 110), followed finally by the N from near (line 130). This gives us A-TEN-CH-A-N. The A-N on the end is used to give an UN sound. The word is understandable but has a slight European accent.

Other examples are COMPUTER, HELLO, YES and NO in Listings 2, 3, 4 and 5, respectively. YES was particularly difficult because the YE sound is not available and a U sound was substituted.

It was certainly not National Semiconductor's intention to use the DT1050 this way, but it does show what can be done with some extra effort. The author would like to know of any other words that the readers may construct.

Conclusion

The possibilities for home use of this new technology are many. Computer voice response is especially

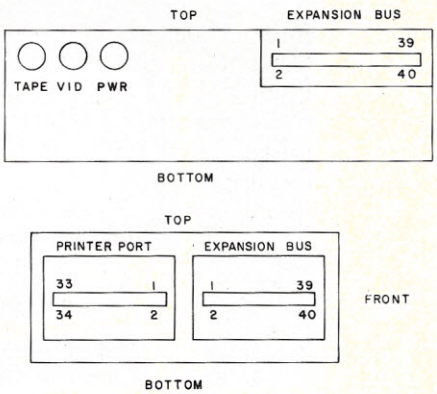


Fig. 2. TRS-80 pin-outs.

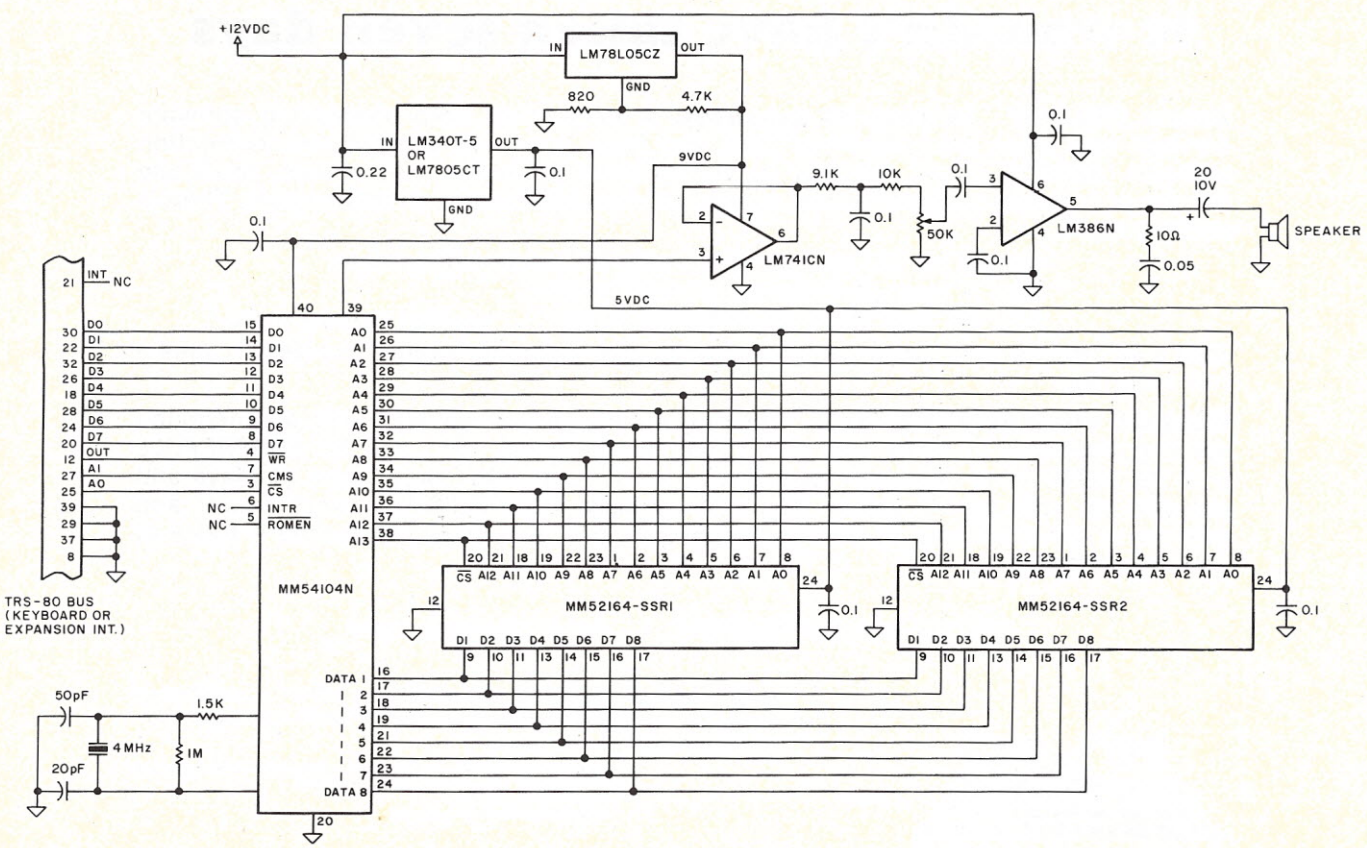


Fig. 1. National Semiconductor/TRS-80 hardware interface.

good where users have nontechnical backgrounds. Hams will now find it economical to provide speech synthesis for automatic station identification or for sophisticated repeater control applications. ■

References

1. Votrax Division, Federal Screw Works, 500 Stephenson Highway, Troy, MI 48084 (313-588-2050).

2. General Instrument Corporation, 600 W. John St., Hicksville, NY 11802 (516-733-3107).

3. Street Electronics Corporation, 3152 E. La Palma Ave., Anaheim, CA 92806 (714-632-9950).

4. Texas Instruments, Inc., PO Box 6448, Midland, TX 79701 (915-685-6500).

5. National Semiconductor Corporation, 2900 Semiconductor Drive, Santa Clara, CA 95051 (408-737-5000).


```
10 'SYNTHESIZE HELLO
20 OUT12,90:          'H FROM HAVE
30 D=20:GOSUB110
40 OUT12,43:          'L
50 D=80:GOSUB110
60 OUT12,103:         'LOW
70 D=70:GOSUB110
80 OUT12,71:          'SILENCE
90 D=500:GOSUB110
100 GOTO 10
110 FOR X=1 TO D
120 NEXT X
130 RETURN
```

Listing 3. Synthesizing "hello."

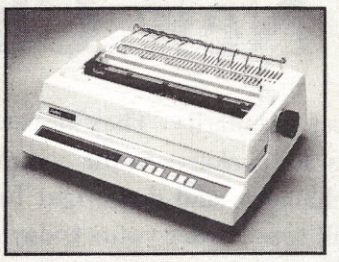
```
10 'SYNTHESIZE YES
20 OUT12,52:          'U
30 D=25:GOSUB90
40 OUT12,81:          'E FROM ERROR
50 D=25:GOSUB90
60 OUT12,129:         'SS
70 D=500:GOSUB90
80 GOTO 20
90 FOR X=1 TO D
100 NEXT X
110 RETURN
```

Listing 4. Synthesizing "yes."

```
10 'SYNTHESIZE NO
20 OUT12,112:         'N FROM NUMBER
30 D=30:GOSUB90
40 OUT12,46:          'O
50 D=60:GOSUB90
60 OUT12,71:          'SILENCE
70 D=500:GOSUB90
80 GOTO 10
90 FOR X= 1 TO D
100 NEXT X
110 RETURN
```

Listing 5. Synthesizing "no."

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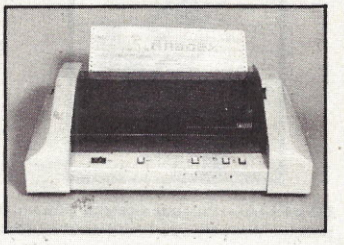
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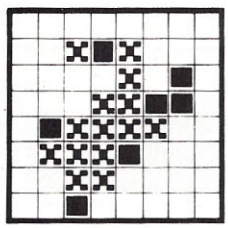
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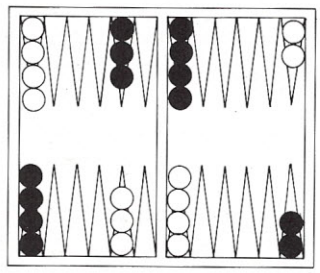


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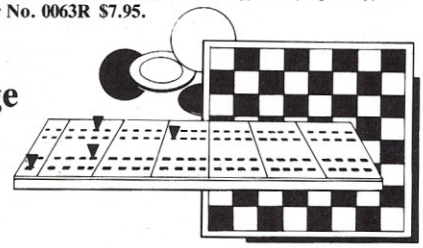
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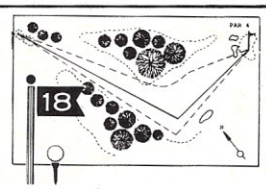
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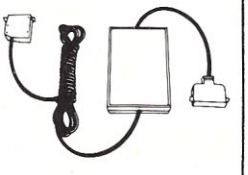
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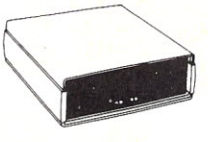
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ALL COMMANDS DIRECTLY SUPPORTED BY ZBASIC

FOR	NEXT	STEP	IF	THEN	ELSE	PEEK
SET	RESET	POINT	CHR$	RANDOM	RND	POKE
DATA	READ	RESTORE	END	GOTO	GOSUB	CLS
INPUT	INKEY$	LET	STOP	OUT	INP	RETURN
PRINT	LPRINT	PRINT@	USR	SGN	INT	ABS
SQR	LEN	ASC	VAL	STR$	POS	ON GOTO
ON GOSUB	REM	NOT	AND	OR		

INTEGER MATH *MULTIPLY /DIVIDE +ADD −SUBTRACT + − 32767
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This program to add intra-line editing to Sorcerer BASIC is just what the doctor ordered.

A Sure Cure for Those "?SN ERROR" Blues

By Randy L. Henne

In squeezing Microsoft BASIC into its 8K ROMPAC, Exidy sacrificed some nice features sometimes found in other BASICs. These include a single-character input command (GET), tape CLOAD* /CSAVE* for character arrays, renumbering, graphics commands and intra-line editing capability.

What Sorcerer lacks in BASIC, however, it makes up for to some extent with its powerful Monitor ROM, which has a wealth of machine language subroutines. By taking advantage of these subroutines, the Z-80 assembler language programmer can write some fairly compact routines to overcome deficiencies such as those listed above.

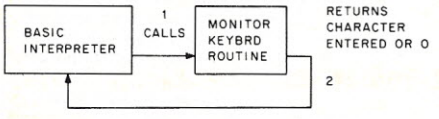


Fig. 1a (SET I=K).

(To learn more about these subroutines and their use, refer to the *Software Internals Manual for the Sorcerer* from Quality Software, or the *Sorcerer Software Manual* from Exidy.)

An excellent example of this technique appeared in the April 1980 issue of *Microcomputing* ("Conjure Up a GET Command for Sorcerer" by C. Kevin McCabe, April 1980, p.46). Similarly, I have used this technique to implement intra-line editing, the topic of this article.

CTRL-E	—Enter EDIT mode, establish dual cursors
UP-arrow	—Move EDIT cursor to beginning of preceding line
DOWN-arrow	—Move EDIT cursor to beginning of following line
RIGHT-arrow	—Copy character under EDIT cursor to BASIC command line
LEFT-arrow (or SHIFT/RUB)	—Backspace EDIT cursor, and RUBOUT last character in BASIC command line
CTRL-D	—"Delete" by moving the EDIT cursor one character to the right without moving the BASIC cursor
REPEAT	—May be used after any cursor command to allow rapid cursor movement, copying, deletion, etc.
CTRL-I	—"Insert" any characters following CTRL-I and before CTRL-N into the BASIC command line, but do not move EDIT cursor
CTRL-N	—Return to "Normal" (cancel Insert Mode)
RETURN (or '@')	—Leave EDIT mode, and pass BASIC command line to BASIC interpreter ('@' causes BASIC to ignore the command line)
Any other Character	—Add the character typed to the BASIC command line, and move both cursors one position to the right (character typed replaces character at EDIT cursor position)

Table 1. EDITIN command summary.

The Intra-Line Editing Problem

As a programmer accustomed to working with powerful text editors on large computer systems, I was annoyed to discover that to change a line of BASIC code on my Sorcerer I had to retype the entire line. I produced some rather inefficient code as a result, since I tended to avoid excessively long statements and frequently added small changes as separate lines rather than retype existing ones.

I soon discovered that the Radio Shack TRS-80 and the Apple II both featured some intra-line editing capabilities, but since I had by that time received my Development PAC, I was developing most of my software in Z-80 assembler language and had temporarily forgotten the inconveniences of BASIC.

Then a few weeks ago, a friend purchased an Apple II, and I had an opportunity to read through one of Apple computer's excellent manuals.

The Applesoft Solution

The Apple's editing method uses the LIST command to display the line to be edited and four escape/key sequences to move the cursor to the be-

Address correspondence to Randy L. Henne, 5870 Wood Flower Court, Burke, VA 22015.

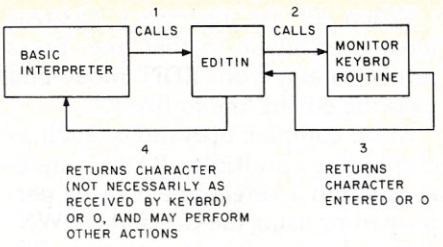


Fig. 1b. (SET I=3000).

ginning of that line. Then, the retype key is used to reenter characters into BASIC, making needed changes by overtyping. Although no provision is made for directly inserting characters within a line, this is usually possible due to the fact that Applesoft inserts extra spaces between words when the LIST command is executed.

```
ADDR   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

3000:  D5 E5 FD E5  CD A2 E1 FD  5E 68 FD 56  69 ED 53 32
3010:  31 FD 5E 6A  16 00 ED 53  34 31 3A 3A  31 B7 28 1A
3020:  CD E8 E9 ED  5B 36 31 FD  73 68 FD 72  69 ED 5B 38
3030:  31 FD 73 6A  FD 72 6B CD  CC E9 CD 18  E0 28 FB F5
3040:  FE 05 20 18  ED 5B 32 31  ED 53 36 31  ED 5B 34 31
3050:  ED 53 38 31  3E 01 32 3A  31 F1 18 09  3A 3A 31 B7
3060:  20 2C F1 18  01 AF B7 F5  CD E8 E9 ED  5B 32 31 FD
3070:  73 68 FD 72  69 ED 5B 34  31 FD 73 6A  FD 72 6B F5
3080:  7B 32 8E 01  F1 CD CC E9  F1 FD E1 E1  D1 C9 3A 3B
3090:  31 B7 28 0B  F1 FE 0E 20  CD AF 32 3B  31 18 C6 F1
30A0:  F5 FE 09 20  08 3E 01 32  3B 31 F1 18  B8 FE 17 20
30B0:  0B CD 18 31  3E 0D CD 18  31 F1 18 A9  FE 1A 20 0D
30C0:  3E 0D CD 18  31 3E 1A CD  18 31 F1 18  98 FE 13 20
30D0:  0D F1 FD 7E  67 F5 3E 13  CD 18 31 F1  18 88 FE 01
30E0:  28 04 FE 7F  20 0B F1 3E  01 CD 18 31  3E 7F C3 66
30F0:  30 FE 04 20  09 3E 13 CD  18 31 F1 C3  65 30 FE 40

ADDR   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

3100:  28 04 FE 0D  20 09 3E 00  32 3A 31 F1  C3 66 30 3E
3110:  13 CD 18 31  F1 C3 66 30  CD 1B E0 FD  5E 68 FD 56
3120:  69 ED 53 36  31 FD 5E 6A  FD 56 6B ED  53 38 31 C9
3130:  00 00 00 00  00 00 00 00  00 00 00 00  20 20 20 20
```

EDITIN in monitor dump format.

Applying the Applesoft Technique to Sorcerer

Obviously, most of us do not have the equipment required to add these features to the BASIC ROMPAC. However, the Monitor SET I=xxxx command can be used to force BASIC to request its input from a user software routine. This routine can intercept keyboard entries and either pass them on to BASIC or take other actions directly. This is the philosophy behind the EDITIN program—it is an editing input driver.

Fig. 1 shows block diagrams of the calling structures. In Fig. 1a, the normal mode (SET I=K), the BASIC interpreter repetitively calls the Monitor KEYBRD routine until a character is actually typed. At this point, BASIC either adds the character to its input command string or performs the requested operation (e.g., return to the READY state on CTRL-C).

Fig. 1b shows the calling structure when EDITIN is loaded at location 3000 hex and SET I=3000 is entered to the Monitor. BASIC calls EDITIN, which in turn calls KEYBRD, looping until a key is pressed. If EDIT mode is in effect, EDITIN can take actions on its own to set flags, move the cursor(s) and return to BASIC with the character entered, no character at all (causing BASIC to immediately call EDITIN again) or some other character (causing BASIC to take other action).

Essentially, EDITIN's function is to maintain two separate cursor locations, called for convenience the BASIC cursor (in the BASIC command line) and the EDIT cursor. When EDIT mode is not in effect, the BASIC cursor is displayed and all operations proceed as if EDITIN did not exist. When EDIT mode is activated (by typing CTRL-E), the edit cursor is displayed and can be moved about the screen as desired, with or without transferring characters to the BASIC command line, until RETURN or @ is entered, terminating EDIT mode and allowing BASIC to process its command appropriately. See Table 1 for a complete summary of EDITIN command characters. (Note: UP-arrow, DOWN-arrow, etc., are entered by holding down either CTRL or SHIFT and pressing the appropriate key on the numeric pad.)

An Editing Example

Let's step through an example of the use of EDITIN to edit a BASIC program line.

Assuming EDITIN is already loaded and the proper SET command has been issued, LIST your BASIC program, stopping the list with CTRL-C when the line you wish to change is displayed on the screen. Next, type CTRL-E to enter EDIT mode and use the UP-arrow to move the EDIT cursor to the line to be edited.

Now, typing RIGHT-arrow will cause the character under the EDIT cursor to appear in the BASIC command line. Continue to type RIGHT-arrow, or use the repeat key, to move the edit cursor to the area where changes are needed.

Then, to replace the character currently under the edit cursor, simply type the new character. To delete the character under the cursor, type CTRL-D.

To insert characters in front of the edit cursor position, type CTRL-I, the character(s) to be inserted, then CTRL-N. Then proceed with any other changes necessary.

If a typographical error is made, RUBOUT (SHIFT-RUB) will backspace as usual (LEFT-arrow also performs the same function).

Program listing.

```
0001 ;
0002 ;        EDITIN - A Keyboard Input Driver Which
0003 ;                 Adds Intra-Line Editing Capability
0004 ;                 to Exidy Sorcerer BASIC
0005 ;
0006          PSECT   ABS
0007          ORG     3000H       ;Relocate as Necessary
0008 ;
0009 ;
0010 ; Use the Monitor 'ENTER' command to enter the OBJECT
0011 ; data at the addresses indicated in the ADDR column.
0012 ;
0013 ; If desired, relocation of EDITIN to another even 4K
0014 ; boundary ('x000') can be easily accomplished by
0015 ; replacing the '30's and '31's in the rightmost-byte
0016 ; of instructions with 'x0's and 'x1's, respectively
```

More

Listing continued.

```
                0017 ;
                0018 ;
3000  D5         0019 EDITIN  PUSH    DE          ;Save Registers
3001  E5         0020         PUSH    HL
3002  FDE5       0021         PUSH    IY
                0022 ;
3004  CDA2E1     0023         CALL    SETUP       ;Point IY to MWA
                0024 ;
3007  FD5E68     0025         LD      E,(IY+68H) ;Save BASIC Cursor
300A  FD5669     0026         LD      D,(IY+69H)
300D  ED533231   0027         LD      (RBASIC),DE
3011  FD5E6A     0028         LD      E,(IY+6AH)
3014  1600       0029         LD      D,0
3016  ED533431   0030         LD      (CBASIC),DE
                0031 ;
301A  3A3A31     0032         LD      A,(EDITMOD) ;Edit Mode ON?
301D  B7         0033         OR      A
301E  281A       0034         JR      Z,GETCHR-$  ;No, Get Character
                0035 ;
3020  CDE8E9     0036         CALL    RESTOR      ;Yes, Set Cursor to
3023  ED5B3631   0037         LD      DE,(REDIT) ; EDIT Location
3027  FD7368     0038         LD      (IY+68H),E
302A  FD7269     0039         LD      (IY+69H),D
302D  ED5B3831   0040         LD      DE,(CEDIT)
3031  FD736A     0041         LD      (IY+6AH),E
3034  FD726B     0042         LD      (IY+6BH),D
3037  CDCCE9     0043         CALL    MOVCUR      ;Execute Cursor Move
                0044 ;
                0045 ;
303A  CD18E0     0046 GETCHR  CALL    KEYBRD      ;Loop until character
303D  28FB       0047         JR      Z,GETCHR-$ ; Received
                0048 ;
303F  F5         0049         PUSH    AF          ;Save Character
3040  FE05       0050         CP      CTRLE       ;Is it Control-E?
3042  2018       0051         JR      NZ,CHKMOD-$ ;No, See if EDIT
                0052 ;                           ; Mode is ON
3044  ED5B3231   0053         LD      DE,(RBASIC) ;Yes, copy BASIC
3048  ED533631   0054         LD      (REDIT),DE  ; Cursor Location
304C  ED5B3431   0055         LD      DE,(CBASIC) ; to EDIT Cursor
3050  ED533831   0056         LD      (CEDIT),DE  ; Location
3054  3E01       0057         LD      A,1         ;Turn EDIT Mode ON
3056  323A31     0058         LD      (EDITMOD),A
3059  F1         0059         POP     AF          ;Clear Stack
305A  1809       0060         JR      NOCF-$      ;Return w/o Character
                0061 ;
305C  3A3A31     0062 CHKMOD  LD      A,(EDITMOD) ;EDIT Mode in Effect?
305F  B7         0063         OR      A
3060  202C       0064         JR      NZ,CHKINS-$ ;Yes, Check Insert
3062  F1         0065         POP     AF          ;No, Return with
3063  1801       0066         JR      CFON-$      ; Character Found
                0067 ;
                0068 ;
3065  AF         0069 NOCF    XOR     A        ;Here if Character Not
                0070 ;                       ; to be Passed to BASIC
                0071 ;
3066  B7         0072 CFON    OR      A        ;Here to Return with
                0073 ;                       ; Character to BASIC
3067  F5         0074         PUSH    AF       ;Save For Now
3068  CDE8E9     0075         CALL    RESTOR   ;Restore Character Under
                0076 ;                       ; EDIT Cursor
306B  ED5B3231   0077         LD      DE,(RBASIC)
306F  FD7368     0078         LD      (IY+68H),E
3072  FD7269     0079         LD      (IY+69H),D
3075  ED5B3431   0080         LD      DE,(CBASIC)
3079  FD736A     0081         LD      (IY+6AH),E
307C  FD726B     0082         LD      (IY+6BH),D
307F  F5         0083         PUSH    AF
3080  7B         0084         LD      A,E
3081  328E01     0085         LD      (018EH),A
3084  F1         0086         POP     AF
3085  CDCCE9     0087         CALL    MOVCUR   ;Restore BASIC Cursor
                0088 ;
3088  F1         0089         POP     AF
3089  FDE1       0090         POP     IY
308B  E1         0091         POP     HL
308C  D1         0092         POP     DE
308D  C9         0093         RET              ;Return to BASIC
                0094 ;                        ; Interpreter
                0095 ;
308E  3A3B31     0096 CHKINS  LD      A,(INSRTMD) ;Insert Mode ON?
3091  B7         0097         OR      A
3092  280B       0098         JR      Z,CKCTLI-$  ;No, Check for CTRL-I
3094  F1         0099         POP     AF          ;Yes, is this CTRL-N?
3095  FE0E       0100         CP      CTRLN
3097  20CD       0101         JR      NZ,CFON-$   ;No, Insert Character
3099  AF         0102         XOR     A           ;Yes, Clear Insert
309A  323B31     0103         LD      (INSRTMD),A ; Mode and Return
309D  18C6       0104         JR      NOCF-$      ; w/o Character
                0105 ;
309F  F1         0106 CKCTLI  POP     AF          ;Is this CTRL-I?
30A0  F5         0107         PUSH    AF
30A1  FE09       0108         CP      CTRLI
```

More →

When all the necessary changes have been made to that line, press return to exit from EDIT mode and pass the edited line to BASIC.

More complex operations, such as combining multiple BASIC statements into a single line, can be performed by using the UP- and DOWN-arrow keys prior to entering RETURN. Bear in mind that BASIC will only replace the line with the same line number as the new line—any other lines no longer needed must be deleted individually.

Application Notes

With the editing abilities provided by EDITIN, BASIC programs can be compressed for more efficient use of memory by deleting REM statements, deleting all but the first two characters of variable names, deleting unnecessary spaces and combining short statements where possible. Program execution can be speeded up by all the above, by replacing constant values with predefined variables and by moving frequently-used subroutines to the top of the program.

While EDITIN was designed for use with BASIC, it can also prove very useful when working in the Monitor. For example, if you have entered the EDITIN program using the monitor ENTER command and wish to save several copies on cassette, the detailed SAVE command need be typed only once:

'SAVE EDIT 3000 313F'

Then, the following keystroke sequence will re-issue the SAVE command:

'UP, UP, CTRL-D, RIGHT, REPEAT..., RETURN'

This sequence can be performed as many times as desired.

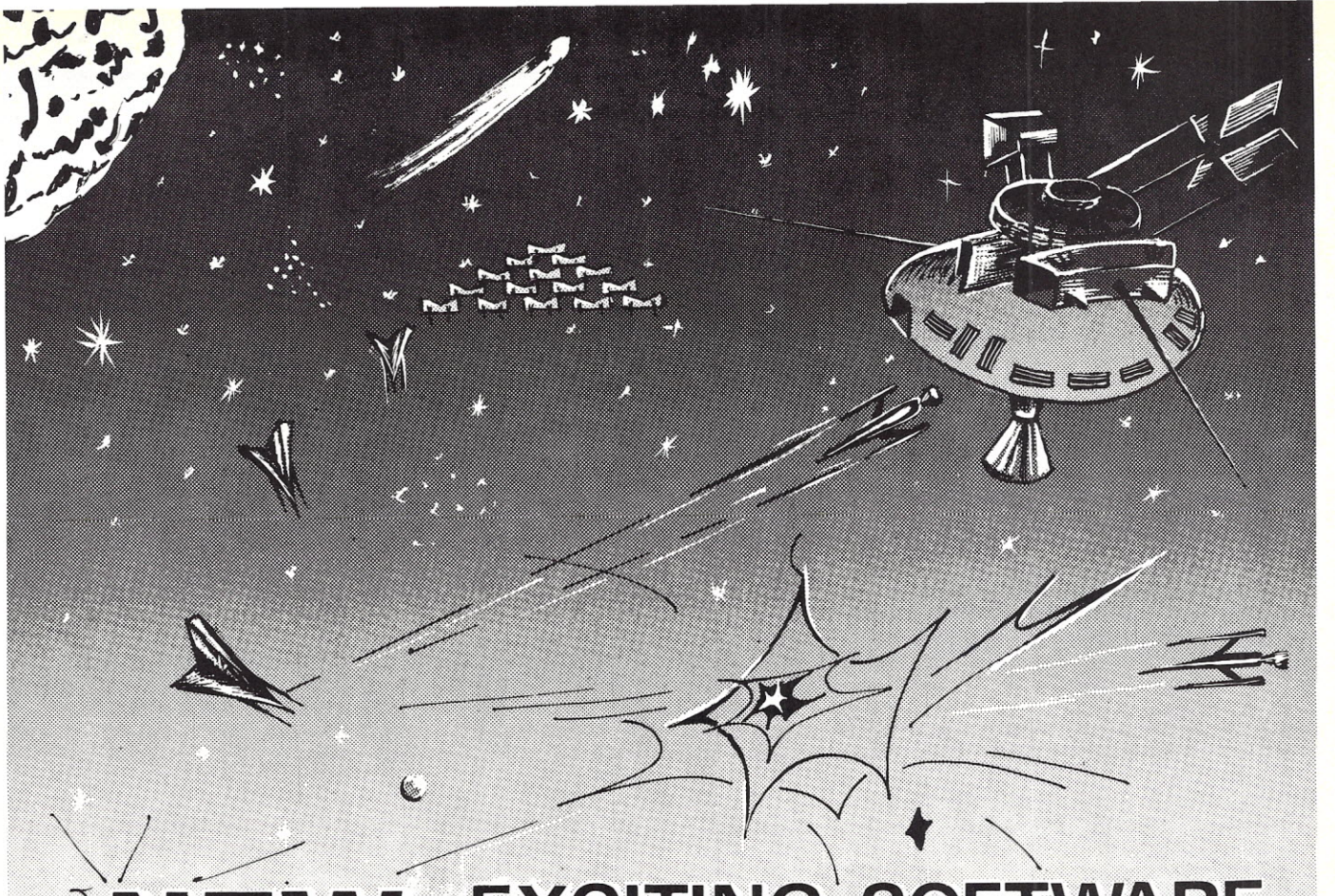
Other uses for EDITIN are left to the imagination of the reader.■

References

"Software Internals Manual for the Sorcerer," by Vic Tolomei, published by Quality Software, 6660 Reseda Blvd., Suite 103, Reseda, CA 91335.

"Conjure Up a GET Command for Sorcerer," by C. Kevin McCabe, in *Kilobaud Microcomputing*, April 1980, p. 46.

"Applesoft II BASIC Programming Reference Manual," published by Apple Computer, Inc., Cupertino, CA 95014.



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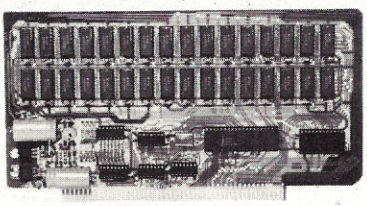
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Listing continued.

```
30A3  2008      0109            JR      NZ,CKUP-$ ;No, try UP-arrow
30A5  3E01      0110            LD      A,1
30A7  323B31    0111            LD      (INSRTMD),A ;Yes, set Insert Mode
30AA  F1        0112            POP     AF          ; Flag and Return
30AB  18B8      0113            JR      NOCF-$      ; w/o Character
                0114 ;
30AD  FE17      0115 CKUP       CP      UPARW     ;Is this UP-arrow?
30AF  200B      0116            JR      NZ,CKDN-$ ; No, try DOWN-arrow
30B1  CD1831    0117            CALL    EDITEXEC  ; Yes, move EDIT Cursor
30B4  3E0D      0118            LD      A,CRET    ;  to Start of Preceding
30B6  CD1831    0119            CALL    EDITEXEC  ;  Line
30B9  F1        0120            POP     AF        ; Clear Stack
30BA  18A9      0121            JR      NOCF-$    ; Return w/o Character
                0122 ;
30BC  FE1A      0123 CKDN       CP      DNARW     ;Is this DOWN-arrow?
30BE  200D      0124            JR      NZ,CKRT-$ ; No, try RIGHT-arrow
30C0  3E0D      0125            LD      A,CRET    ; Yes, Move EDIT Cursor
30C2  CD1831    0126            CALL    EDITEXEC  ;  to Start of Next Line
30C5  3E1A      0127            LD      A,DNARW
30C7  CD1831    0128            CALL    EDITEXEC
30CA  F1        0129            POP     AF        ; Clear Stack
30CB  1898      0130            JR      NOCF-$    ; Return w/o Character
                0131 ;
30CD  FE13      0132 CKRT       CP      RTARW     ;Is this RIGHT-arrow?
30CF  200D      0133            JR      NZ,CKLT-$ ; No, try LEFT-arrow
30D1  F1        0134            POP     AF
30D2  FD7E67    0135            LD      A,(IY+67H) ;Yes, get Character
                0136 ;                             ;  Under Cursor
30D5  F5        0137            PUSH    AF
30D6  3E13      0138            LD      A,RTARW   ; Execute Right Move
30D8  CD1831    0139            CALL    EDITEXEC
30DB  F1        0140            POP     AF        ; Then Return with
30DC  1888      0141            JR      CFON-$    ;  Character that was
                0142 ;                             ;  Under the Cursor
                0143 ;
30DE  FE01      0144 CKLT       CP      LTARW     ;Is this LEFT-arrow?
30E0  2804      0145            JR      Z,LEFT-$
30E2  FE7F      0146            CP      RUBOUT    ;  Or RUBOUT?
30E4  200B      0147            JR      NZ,CKCTLD-$
30E6  F1        0148 LEFT       POP     AF        ; Yes, Execute Left
30E7  3E01      0149            LD      A,LTARW   ;   Cursor Move
30E9  CD1831    0150            CALL    EDITEXEC
30EC  3E7F      0151            LD      A,RUBOUT  ; and Return with
30EE  C36630    0152            JP      CFON      ;  RUBOUT
                0153 ;
30F1  FE04      0154 CKCTLD     CP      CTRLD     ;Is this CTRL-D?
30F3  2009      0155            JR      NZ,CKATS-$
30F5  3E13      0156            LD      A,RTARW   ; Yes, Execute Right
30F7  CD1831    0157            CALL    EDITEXEC  ;   Cursor Move
30FA  F1        0158            POP     AF        ;   and Return w/o
30FB  C36530    0159            JP      NOCF      ;   Character
                0160 ;
30FE  FE40      0161 CKATS      CP      ATSIGN    ;Is this '@'?
3100  2804      0162            JR      Z,EXIT-$
3102  FE0D      0163            CP      CRET      ;  or Carriage Return?
3104  2009      0164            JR      NZ,NORMCHR-$
3106  3E00      0165 EXIT       LD      A,0       ; Yes, Turn EDIT Mode
3108  323A31    0166            LD      (EDITMOD),A ; Flag OFF
310B  F1        0167            POP     AF
310C  C36530    0168            JP      CFON      ;Return with Character
                0169 ;
310F  3E13      0170 NORMCHR    LD      A,RTARW   ;If Other Character,
3111  CD1831    0171            CALL    EDITEXEC  ; Execute Right Cursor
3114  F1        0172            POP     AF        ; Move and Return
3115  C36630    0173            JP      CFON      ; with Character
                0174 ;
3118  CD1BE0    0175 EDITEXE    CALL    VIDEO     ;Send Control Character
311B  FD5E68    0176            LD      E,(IY+68H)
311E  FD5669    0177            LD      D,(IY+69H)
3121  ED533631  0178            LD      (REDIT),DE ; Save New Cursor
3125  FD5E6A    0179            LD      E,(IY+6AH)
3128  FD566B    0180            LD      D,(IY+6BH)
312B  ED533831  0181            LD      (CEDIT),DE
312F  C9        0182            RET               ; and Return
                0183 ;
3130  0000      0184            DEFW    0
3132  0000      0185 RBASIC     DEFW    0       ;BASIC CURSOR ROW
3134  0000      0186 CBASIC     DEFW    0       ;BASIC CURSOR COL
3136  0000      0187 REDIT      DEFW    0       ;EDIT  CURSOR ROW
3138  0000      0188 CEDIT      DEFW    0       ;EDIT  CURSOR COL
                0189 ;
313A  00        0190 EDITMOD    DEFB    0       ;EDIT MODE FLAG
313B  00        0191 INSRTMD    DEFB    0       ;INSERT MODE FLAG
                0192 ;
>E1A2           0193 SETUP      EQU     0E1A2H  ;MONITOR SUBROUTINES
>E9E8           0194 RESTOR     EQU     0E9E8H
>E9CC           0195 MOVCUR     EQU     0E9CCH
>E018           0196 KEYBRD     EQU     0E018H
>E01B           0197 VIDEO      EQU     0E01BH
                0198 ;
>007F           0199 RUBOUT     EQU     127
>0004           0200 CTRLD      EQU     4
```

More →

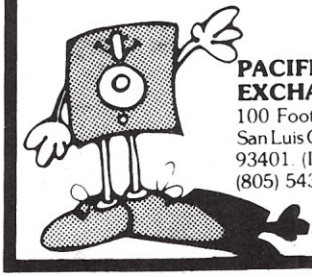
Listing continued.

```
>0040           0201 ATSIGN  EQU     64
>000D           0202 CRET    EQU     13
>0001           0203 LTARW   EQU     1
>0013           0204 RTARW   EQU     19
>001A           0205 DNARW   EQU     26
>0017           0206 UPARW   EQU     23
>0005           0207 CTRLE   EQU     5
>0009           0208 CTRLI   EQU     9
>000E           0209 CTRLN   EQU     14
                0210 ;
ERRORS=0000

ATSIGN    0040 CBASIC    3134 CEDIT    3138
CFON      3066 CHKINS    308E CHKMOD   305C
CKATS     30FE CKCTLD    30F1 CKCTLI   309F
CKDN      30BC CKLT      30DE CKRT     30CD
CKUP      30AD CRET      000D CTRLD    0004
CTRLE     0005 CTRLI     0009 CTRLN    000E
DNARW     001A EDITEX    3118 EDITIN   3000
EDITMO    313A EXIT      3106 GETCHR   303A
INSRTM    313B KEYBRD    E018 LEFT     30E6
LTARW     0001 MOVCUR    E9CC NOCF     3065
NORMCH    310F RBASIC    3132 REDIT    3136
RESTOR    E9E8 RTARW     0013 RUBOUT   007F
SETUP     E1A2 UPARW     0017 VIDEO    E01B
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By Cary N. Davids

I recently built an eight-voice S-100 music board to help me write arrangements for a 17-piece jazz band. The board is controlled by my SD Systems Z-80 Starter Kit (see my article "JazZ-80," *Microcomputing*, May 1980, p. 148, for a complete description). To play a song you must first enter the notes and durations for each voice into tables in RAM. Every note in the four-octave range of the board has its own one-byte designation, and the durations, which vary from triplet thirty-second notes on up, take another byte.

After using this board for a while, I found that entering music one hexadecimal character at a time is quite tedious, and I began looking for a less painful method.

It soon became clear that adding a piano keyboard would offer many advantages. I'm not much of a pianist, but I felt I could reasonably play in real time the notes belonging to a single voice, leaving to the computer the task of producing the correct song table in RAM.

At the same time, the computer would need to cause the appropriate notes to be played by the music board as they were being entered on the keyboard. Details like rests, articulation between notes and obtaining a "swing" feel should all be taken care of if the software transferred faithfully to the song table the time intervals involved in each keypress and rest. Since each voice would still have to be entered separately, a common tempo would have to be established, and the computer would need to know where in RAM the notes were to be stored.

My Z-80 Starter Kit has two parallel I/O ports (Z-80-PIO) and four counter-timer channels (Z-80-CTC), so it was natural to consider a parallel port for the interface between computer and keyboard. The software that I previously developed for playing the music uses two cascaded channels of the Z-80-CTC as a real-time clock, and I expected to be able to create a similar program that would read the keyboard. As it turned out, this proved to be quite simple.

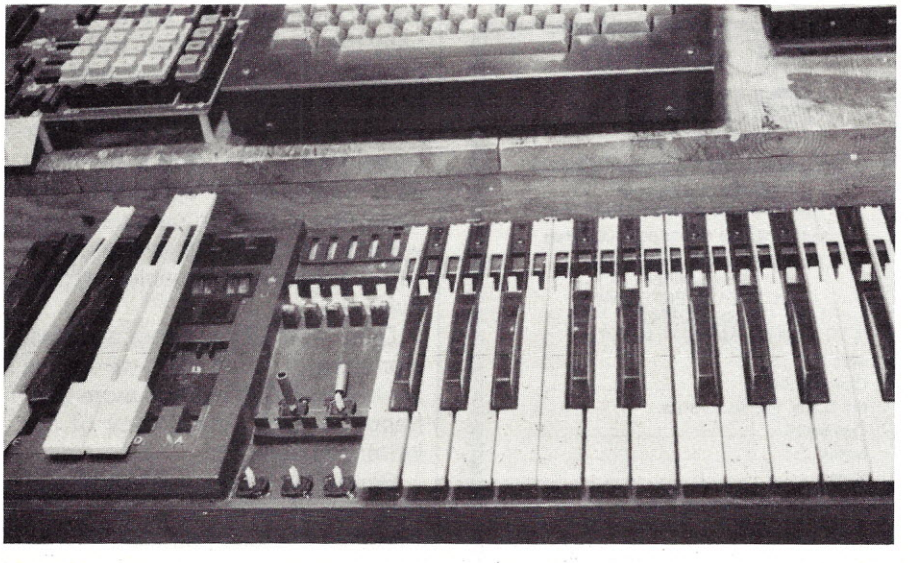


Photo 1. Top view of the piano keyboard. The lower five keys have been removed to show how the switches are positioned under the keys.

Hardware

The hardware requirements include some kind of piano keyboard and a way to encode it to match the existing note scheme, if possible. I first checked with local piano stores for broken electronic organs with salvageable keyboards. Some were available, but were too expensive. Various manufacturers sell three- and four-octave keyboards, but again they are a bit steep.

A musician friend finally gave me the three-octave keyboard from a broken Magnus Chord Organ. A sim-

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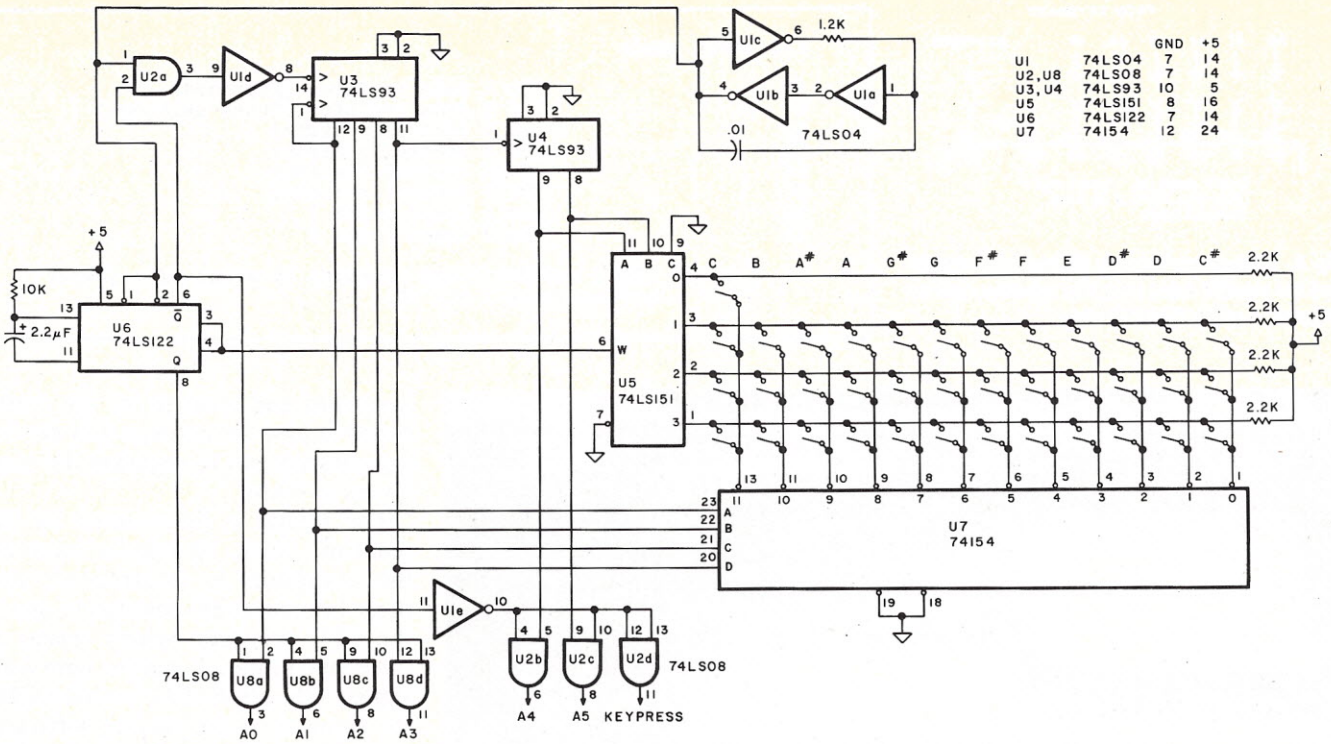


Fig. 1. Schematic of encoder for the three-octave piano keyboard.

ilar item is available from Meshna (PO Box 62, E. Lynn, MA 01904) for less than $15. Since the keyboard is not electrical, Meshna offers a package of 48 microswitches for $4. These are actually switches made for an ASCII keyboard; when mounted under the piano keys and secured to the base with some epoxy, they give the keys about the right tension. I used a small piece of self-adhesive weatherstripping under the white keys to give the correct spacing between switch and key, and some brass tubing under the black keys. Photo 1 shows the mounting of the switches.

Keyboard Encoder

The encoding scheme for the keyboard depends on how the individual notes are identified. In my configuration the 12 notes of each octave use the four least-significant bits of an eight-bit hexadecimal word, and the upper four bits are used to denote the octave. For example, the lowest note, C# two octaves below middle C, is denoted by the number 80H. Middle C is 9BH, and the highest note, C two octaves above middle C, is 0BBH. This grouping of the notes into octaves, rather than numbering them sequentially, simplifies the keyboard encoder circuitry.

Not only must the encoder make available to the computer the hexadecimal equivalent of the note that has been played, but the data must also be present as long as the key is actually being pressed. This enables the duration of that note to be calculated by the software. When no key is pressed, I wanted the encoder output to be zero, denoting a rest.

My keyboard has 37 keys, and a simple calculation shows that six bits should be sufficient to describe all the notes. However, the no-keypress requirement of all zeros on the output means that one more bit must be used as a keypress signal. Thus, the encoder needs a nine-conductor cable between it and the computer (seven data lines, ground and +5 V dc).

For this application I assembled a simple scanning encoder from TTL logic, and the schematic is shown in Fig. 1. In this circuit, the clock generator, consisting of the inverters U1a–c, produces a square wave with a period of about 20 us. These pulses are counted in the four-bit note counter U3 and the two-bit octave counter U4, the outputs of which are sent to (normally closed) AND gates U8a–d and U2b,c. One complete scan of the keyboard takes slightly more than one ms.

The key switches are wired in a 12×4 note-octave matrix. When a key is pressed and the counters have cycled to the corresponding code for that key, a signal emerges from multiplexer U5 to trigger one-shot U6. Since U6 is constantly being retriggered by clock pulses on pins 1 and 2, its Q output (pin 8) stays high for the entire duration of the keypress, and $\overline{Q}$ (pin 6) stays low. $\overline{Q}$ is used to shut off the input to the counters, and Q opens the AND gates to pass the desired note code to the computer. The signal Q is also provided as the keypress output.

When the depressed key is released, all outputs return to zero, and keyboard scanning is resumed. Keyswitch bounce is eliminated by the 22 ms time constant associated with one-shot U6.

The encoder was wire-wrapped on a small prototype board. Photo 2 shows the underside of the keyboard, including the encoder board and some of the switches.

Computer Interface

The keyboard encoder output is suitable for direct connection to a parallel I/O port. Normally, when interfacing a parallel keyboard, a data available pulse or level is generated when a key is pressed, and is connected to one bit of a separate status port. I find this extra port unnecessary, even for an ASCII keyboard. Only six bits are used for data in the present case (seven for an ASCII keyboard), and thus the input port's most significant bit can be used to receive the data available signal. Of course,

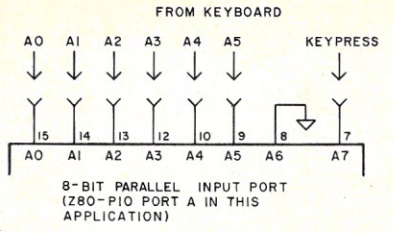


Fig. 2. Connections between the keyboard outputs and the parallel input port. Pin numbers refer to I/O port A of the Z-80-PIO chip.

```
I/O Ports used:

80          PIO A data register (Keyboard)
81          PIO B data register (Sense switches)
82          PIO A control register
83          PIO B control register
84          CTC/0 control register
87          CTC/3 control register
A0          Music board voice 1
A1          Music board voice 2

Note: CTC/0 and CTC/3 are cascaded by means of a jumper
      between pins 7 and 20.
```

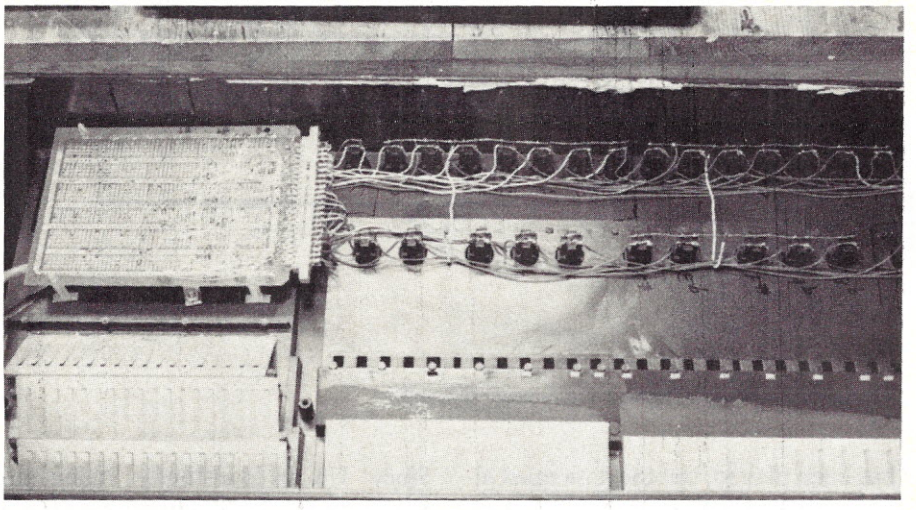


Photo 2. Underside view of the piano keyboard.

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the input software must be written to respond correctly to this situation.

For the present encoder, the six data bits are connected to the lowest six bits of the I/O port. The unused next bit of the port is held low for noise considerations, and the keypress line (pin 11 of U2) is connected to the most significant bit of the port. I used DB25 connectors at the computer end. The I/O port is initialized as an input port by the software. A connection schematic is shown in Fig. 2.

Software

The music entry software has three tasks: to set the tempo for playing the notes on the keyboard, to read the keyboard and arrange for the music board to play the notes as they are being entered and to organize the song tables in RAM.

The tempo is determined by the real-time clock. At regular intervals the computer is interrupted, and these interrupts are counted in one of the CPU registers, which serves as the beat counter. A quarter note is assigned a duration of 12 counts (0CH), the same as in the playing software. At the beginning of each beat a short note is sounded by one of the voices of the music board, letting the player hear the tempo.

During program initialization, the address of the song table is calculated with the help of the first three sense switches (port 81H). If these switches are off, the address is that of the first voice—in this case, 4000H. Each binary switch increment of 1 adds 400H to the base address. Sense switch 7 is used to lower all the notes for a particular voice by one octave. The default range is the upper three octaves.

The sense switches are not essential to the operation of the music system, but are used simply as a convenient way of entering data into the computer. Other means, such as the hex keyboard, could be used to enter the necessary numbers before the program is executed. A simple schematic for eight sense switches is found in my May 1980 article.

The program spends most of its

Listing 1. Piano interface program.

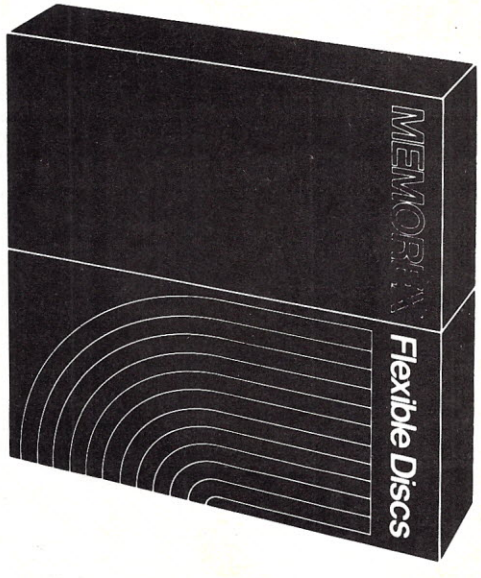
```
                    Initialization Routine

2500 D9             EXX             Initialize beat timer
  01 08             EX AF,AF'
  02 11 00 0C       LD DE,0C00H
  05 01 A1 BB       LD BC, 0BBA1H
  08 2E 01          LD L,01H
  0A AF             XOR A
  0B ED 41          OUT (C),B       Output first beat note
  0D D9             EXX             Initialize ports
  0E 08             EX AF,AF'
  0F 3E 25          LD A,35H        CTC/0 control word
```

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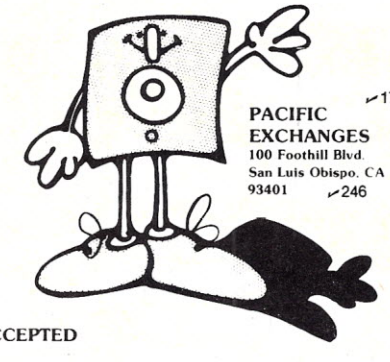


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Listing 1 continued.

```
   11 D3 84            OUT (84H),A
   13 3E 20            LD A,20H        CTC/0 time constant
   15 D3 84            OUT (84H),A
   17 3E 25            LD A,25H        Interrupt vector hi byte
   19 ED 47            LD I,A
   1B 3E 86            LD A,86H        Interrupt vector lo byte
   1D D3 84            OUT (84H),A
   1F 3E D5            LD A,0D5H       CTC/3 control word
   21 D3 87            OUT (87H),A
   23 3E 14            LD A,14H        CTC/3 time constant
   25 D3 87            OUT (87H),A
   27 3E CF            LD A,0CFH       Initialize keyboard and
   29 D3 82            OUT (82H),A      sense switch ports as
   2B D3 83            OUT (83H),A      input ports
   2D 3E FF            LD A,0FFH
   2F D3 82            OUT (82H),A
   31 D3 83            OUT (83H),A
   33 21 56 25         LD HL,2556H     Address of octave decrement
   36 DB 81            IN A,(81H)      Input sense switches
   38 CB 27            SLA A           Multiply by 2
   3A CB 27            SLA A           Multiply by 2, carry if sw. 7 on
   3C 38 04            JR C,SUB-$
   3E 36 00            LD (HL),DEC     DEC=0 for no octave shift
   40 18 02            JR CONT-$
   42 36 10      SUB:  LD (HL),DEC     DEC=10H for 1 octave lower
   44 C6 40      CONT: ADD A,40H       Song table address hi byte
   46 67               LD H,A          Put in H
   47 AF               XOR A           Clear registers
   48 57               LD D,A
   49 4F               LD C,A
   4A 6F               LD L,A
   4B 77               LD (HL),A       Send rest to memory
   4C ED 5E            IM 2            Interrupt mode 2
   4E FB               EI              Enable interrupts

                  Keyboard Processing Routine

254F DB 80         INP: IN A,(80H)      Input keyboard
   51 B9               CP C            Same as previous character?
   52 28 FB            JR Z,INP-$      If yes, go back for more
   54 4F               LD C,A          If no, store in C
   55 D6 00 (or 10)    SUB DEC         DEC has been loaded previously
   57 30 01            JR NC,OUT-$     Continue unless carry flag set
   59 AF               XOR A           Clear for rest shifted 1 octave
   5A D3 A0       OUT: OUT (0A0H),A    Send note to music board
   5C 5F               LD E,A          Store A temporarily
   5D 7A               LD A,D          Bring duration counter to A
   5E FE 00            CP 0            Is it 0?
   60 28 05            JR Z,FIX-$      If so, send note to table
   62 23               INC HL          Point to duration location
   63 72               LD (HL),D       Send duration to table
   64 23               INC HL          Point to next note location
   65 16 00            LD D,0          Clear duration counter
   67 73          FIX: LD (HL),E       Send note to table
   68 18 E5            JR INP-$        Go back for more

                  Interrupt Service Routine

256A 08                 EX AF,AF'       Save flags
   6B 14                INC D           Increment duration counter
   6C D9                EXX             Change registers
   6D 3C                INC A           Increment beat counter
   6E BA                CP D            Is it 12D?
   6F 28 07             JR Z,REIN-$     If so, start again
   71 BD                CP L            Is it 1 or greater?
   72 38 05             JR C,OUTN-$     If not, output beat note
   74 ED 59             OUT (C),E       If so, output rest to board
   76 18 03             JR EXIT         Prepare return to program
   78 AF          REIN: XOR A           Clear beat counter
   79 ED 41       OUTN: OUT (C),B       Output beat note
   7B D9          EXIT: EXX             Change registers back
   7C 08                EX AF,AF'
   7D FB                EI              Enable interrupts
   7E ED 4D             RETI            Return from interrupt

2586 6A 25          Interrupt vector

Song table area:

4000-43FF           Voice 1
4400-47FF           Voice 2
4800-4BFF           Voice 3
4C00-4FFF           Voice 4
5000-53FF           Voice 5
5400-57FF           Voice 6
5800-5BFF           Voice 7
5C00-5FFF           Voice 8
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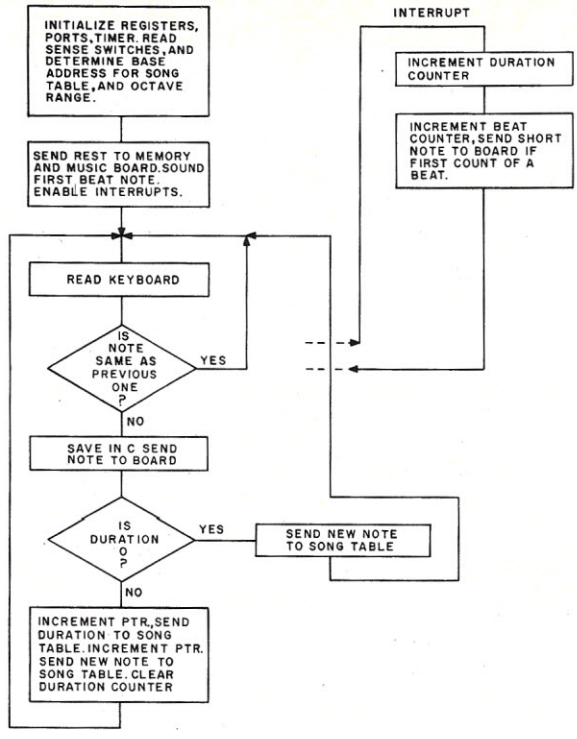


Fig. 3. Flowchart for the music entry program.

time in a loop that reads the keyboard port. Nothing is done if no change from the previous value found there has occurred. Periodically, the real-time clock interrupts the main program, and when this happens, the duration register is incremented and the tempo bookkeeping is done.

When the keyboard output changes to a new note or a rest, the appropriate information is stored in the song table, and the new note or rest is sent to the music board.

A flow diagram for the program is shown in Fig. 3, and the program in its entirety is given in Listing 1. All variables except the song tables are stored in the CPU registers, with one set of registers dealing only with playing the notes and constructing the song tables, while the other set is used to take care of sounding the beat notes to set the tempo.

Conclusion

A piano keyboard has been electrified, encoded and interfaced to the music system described in "JazZ-80." The keyboard is used in conjunction with a program that constructs song tables in RAM from notes played in real time on the keyboard. This has made the operation of entering multivoice music into the computer much more convenient and pleasant. Future plans include the addition of a video display facility and an ASCII keyboard in order to provide the capability of editing the song tables after they have been created.■

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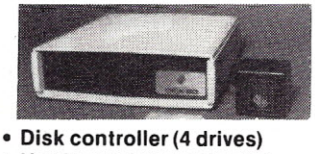
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Trilogy—This contest has its origins in the simple game of tic-tac-toe. The object of the game is to place three of your colors, in a row, into the delta-like, multi-level display. The rows may be horizontal, vertical, diagonal and wrapped around, through the "third dimension". Your Apple will be trying to do the same. You can even have your Apple play against itself!

Minimum system requirements are an Apple II or Apple II Plus computer with 32K of memory and one minidisk drive. Mimic requires Applesoft in ROM, all others run in RAM or ROM Applesoft.

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Solar Energy For The Home

With the price of fossil fuels rising astronomically, solar space-heating systems are starting to become very attractive. But is solar heat cost-effective for you? This program can answer that question.

Just input this data for your home: location, size, interior details and amount of window space. It will then calculate your current heat loss and the amount of gain from any south facing windows. Then, enter the data for the contemplated solar heating installation. The program will compute the NET heating gain, the cost of conventional fuels vs. solar heat, and the calculated payback period—showing if the investment will save you money.

Solar Energy for the Home: It's a natural for architects, designers, contractors, homeowners...anyone who wants to tap the limitless energy of our sun.

Minimum system requirements are an Apple II or Apple II Plus with one disk drive and 28K of RAM. Includes AppleDOS 3.2.

Order No. 0235AD (disk-based version) $34.95

Math Fun

The Math Fun package uses the techniques of immediate feedback and positive reinforcement so that students can improve their math skills while playing these games:

Hanging—A little man is walking up the steps to the hangman's noose. But YOU can save him by answering the decimal math problems posed by the computer. Correct answers will move the man down the steps and cheat the hangman.

Spellbinder—You are a magician battling a computerized wizard. In order to cast death clouds, fireballs and other magic spells on him, you must correctly answer problems involving fractions.

Whole Space—Pilot your space craft to attack the enemy planet. Each time you give a correct answer to the whole number problems, you can move your ship or fire. But for every wrong answer, the enemy gets a chance to fire at you.

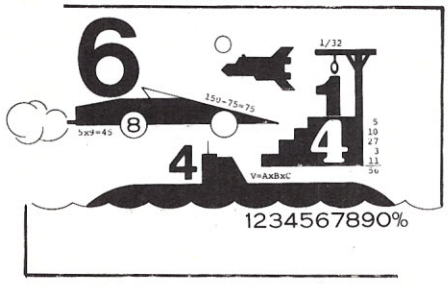
Car Jump—Make your stunt car jump the ramps. Each correct answer will increase the number of buses your car must jump over. These problems involve calculating the areas of different geometric figures.

Robot Duel—Fire your laser at the computer's robot. If you give the correct answer to problems on calculating volumes, your robot can shoot at his opponent. If you give the wrong answer, your shield power will be depleted and the computer's robot can shoot at yours.

Sub Attack—Practice using percentages as you maneuver your sub into the harbor. A correct answer lets you move your sub and fire at the enemy fleet.

All of these programs run in Applesoft BASIC, except Whole Space, which requires Integer BASIC.

Order No. 0160AD $19.95



Paddle Fun

This new Apple disk package requires a steady eye and a quick hand at the game paddles! It includes:

Invaders—You must destroy an invading fleet of 55 flying saucers while dodging the carpet of bombs they drop. Your bomb shelters will help you—for a while. Our version of a well known arcade game! Requires Applesoft in ROM.

Howitzer—This is a one or two person game in which you must fire upon another howitzer position. This program is written in HIGH-RESOLUTION graphics using different terrain and wind conditions each round to make this a demanding game. The difficulty level can be altered to suit the ability of the players. Requires Applesoft in ROM.

Space Wars—This program has three parts: (1) Two flying saucers meet in laser combat—for two players, (2) two saucers compete to see which can shoot out the most stars—for two players, and (3) one saucer shoots the stars in order to get a higher rank—for one player only. Requires Applesoft.

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Skybombers

Two nations, seperated by The Big Green Mountain, are in mortal combat! Because of the terrain, their's is an aerial war—a war of SKYBOMBERS!

In this two-player game, you and your opponent command opposing fleets of fighter-bombers armed with bombs and missiles. Your orders? Fly over the mountain and bomb the enemy blockhouse into dust!

Flying a bombing mission over that innocent looking mountain is no milk run. The opposition's aircraft can fire missiles at you or you may even be destroyed by the bombs as they drop. Desperate pilots may even ram your plane or plunge into your blockhouse, suicidally.

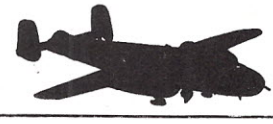
Flight personnel are sometimes forced to parachute from badly damaged aircraft. As they float helplessly to earth, they become targets for enemy missiles.

The greater the damage you deal to your enemy, the higher your score, which is constantly updated at the bottom of the display screen.

The sounds of battle, from exploding bombs to the pathetic screams from wounded parachutists, remind each micro-commander of his bounden duty. Press On, SKYBOMBERS—Press On!

Minimum system requirements: An Apple II or Apple II Plus, with 32K RAM, one disk drive and game paddles.

Order No. 0271AD (disk-based version) $19.95



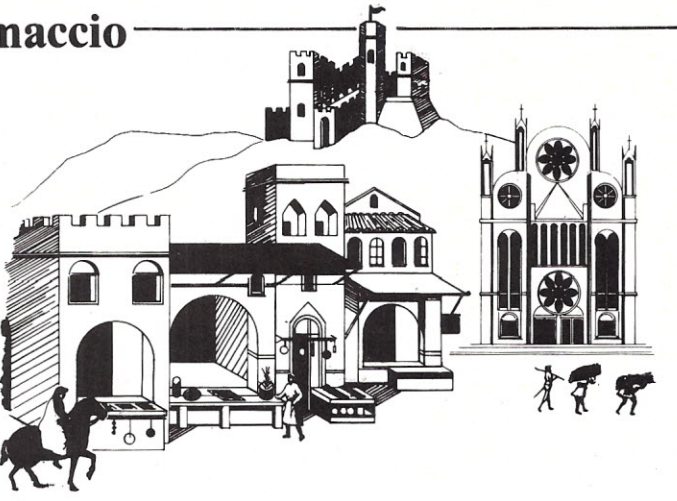
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Apple* Software
From Instant Software

Santa Paravia and Fiumaccio



Buon giorno, signore!

Welcome to the province of Santa Paravia. As your steward, I hope you will enjoy your reign here. I feel sure that you will find it, shall we say, profitable.

Perhaps I should acquaint you with our little domain. It is not a wealthy area, signore, but riches and glory are possible for one who is aware of political realities. These realities include your serfs. They constantly request more food from your grain reserves, grain that could be sold instead for gold florins. And should your justice become a trifle harsh, they will flee to other lands.

Yet another concern is the weather. If it is good, so is the harvest. But the rats may eat much of our surplus and we have had years of drought when famine threatened our population.

Certainly, the administration of a growing city-state will require tax revenues. And where better to gather such funds than the local marketplaces and mills? You may find it necessary to increase custom duties or tax the incomes of the merchants and nobles. Whatever you do, there will be far-reaching consequences. . . and, perhaps, an elevation of your noble title.

Your standing will surely be enhanced by building a new palace or a magnificent *cattedrale*. You will do well to increase your landholdings, if you also equip a few units of soldiers. There is, alas, no small need for soldiery here, for the unscrupulous Baron Peppone may invade you at any time.

To measure your progress, the official cartographer will draw you a *mappa*. From it, you can see how much land you hold. how much of it is under the plow and how adequate your defenses are. We are unique in that here, the map IS the territory.

I trust that I have been of help, signore. I look forward to the day when I may address you as His Royal Highness, King of Santa Paravia. *Buona fortuna* or, as you say, "Good luck". For the Apple 48K.

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Tune in to several dozen functions with this multichannel A/D converter.

Multiple Control With the Multifaceted H8

By Larry T. Wier

In order for a digital computer to control or understand the results of any analog function, a conversion from analog to digital (A to D) or digital to analog (D to A) must be accomplished. This article describes the A to D conversion (ADC), with the Heath H8 as the digital computer.

One of the features of the Heath H8 is the versatile H8-2 parallel interface. It is a three-channel (port) device that has independently addressable input and output lines along with the required handshaking. Combined with the Heath software, it is a versatile I/O device.

By combining one port of the H8-2 with a multichannel ADC and some simple software, up to several dozen different functions can be controlled from a single port. Fig. 1 provides an overview of how this system would be attached to the H8-2. The ADC is remote to the H8-2 (up to ten feet), and the source of signals to the ADC is remote (up to 100 feet) to the ADC.

Introduction

Before a detailed explanation of the system is possible, a few terms must be defined. For the software described herein to function correctly, the hardware control must be duplicated.

The software is Heath Extended B.H. BASIC, version 10.05. The command structure for version 10.02 is the same as version 10.05, although I have not tried version 10.02. In the hardware, I used port addresses 0, the control address, and 1, the data I/O address.

I omitted details of assembly and printed circuit layout because each installation could demand a different card layout. None of the parts is unique or expensive, and layout is not critical. Parts cost will depend on sources, but should not exceed $10. Provision for a ±15 V regulated power source is required. Depending on parts used, the ADC will operate from 0 °C to 50 °C at full accuracy.

Hardware Description

The obvious function of the ADC is to convert analog signals to their digital counterparts. In this instance, another purpose is to control several functions using a single H8-2 port (see Fig. 2).

The output data lines (D_0–D_7) are buffered and passed through the ADC enclosure. Three lines (D_0, D_1 and D_2) are tapped and used as address lines (DA_0, DA_1 and DA_2) as defined in Fig. 3. P1 is a 25-pin connector used to mate with the enclosure connector.

The handshaking lines of P1 (pins 10 through 16) must be connected as shown in Figs. 2 and 3, or the software will not work correctly. No plug types or pin numbers other than the H8-2 are defined, since they will be determined by printed circuit board layout and function.

If long analog lines are required, they should be shielded types such as coax or microphone cable. Connectors would then depend on the type of wire used. Output lines are digital (on/off) lines. U_7 and U_8 are capable of driving lines up to approximately 100 feet, depending on data rate and wire type. The maximum voltage on any of the output lines should not exceed +5 V.

Hardware Design

Design of the ADC is a combination of proven circuits. The ADC has five basic parts combined to form the system:

1. U_7 and U_8 are 4050B CMOS devices used to increase drive for long line conditions. They could be omitted if desired.
2. U_5 and U_6 are the same as U_7

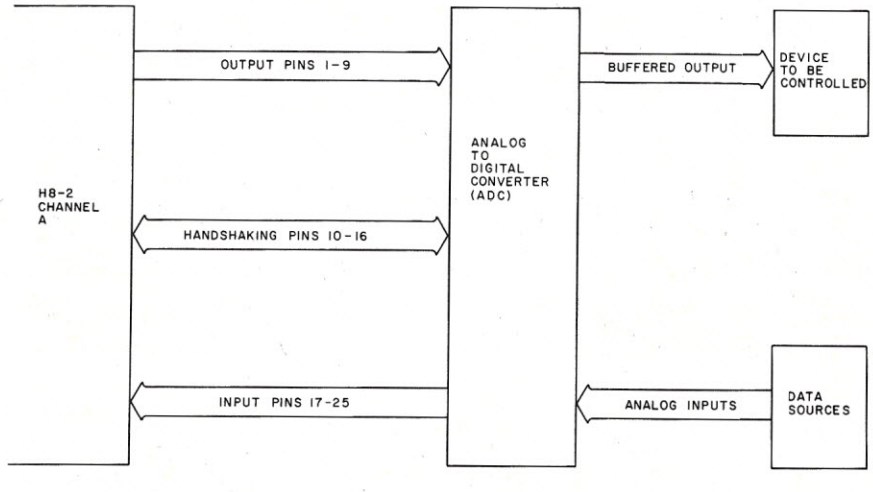


Fig. 1. H8-2 interface block diagram.

Larry T. Wier, 1068 149 Place, S.E., Bellevue, WA 98007.

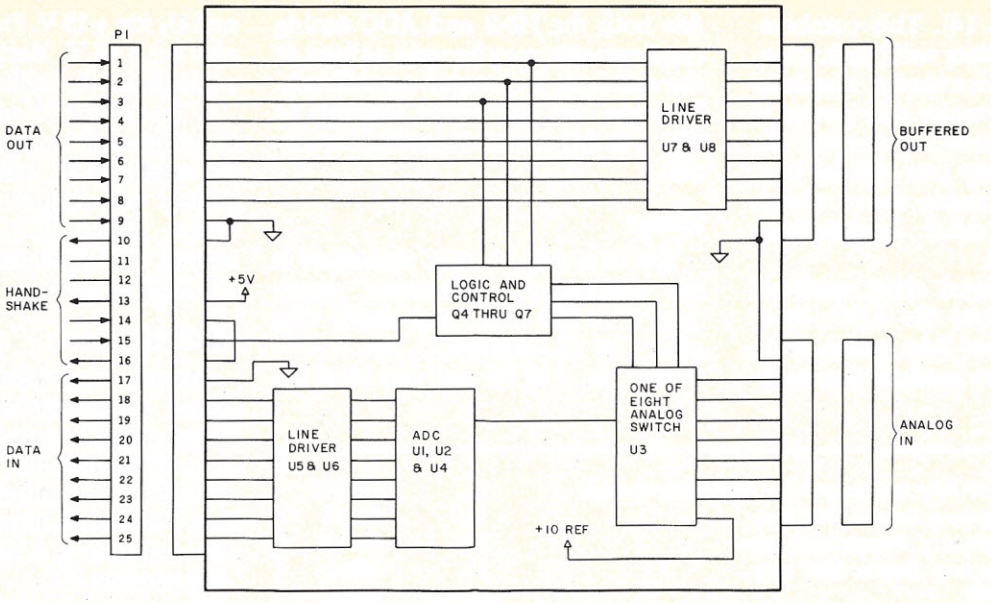


Fig. 2. Signal flow diagram.

and U_8 and are used as line drivers as well as level (CMOS to TTL) shifters.

3. U_3 is a 4051B CMOS multiplexer/demultiplexer used as an eight-line-to-one-line analog switch.

4. Q_2 through Q_7 are general-purpose NPN (2N2222) transistors used for the interface control logic and level shift from TTL to CMOS.

5. U_1, U_2 and U_4, along with Q_1 and C_1, form the ADC, which can be further divided into four parts. U_1 is an LM 311 voltage comparator. Q_1 and R_1 form the constant current source to charge C_1. U_4 is a 4001B CMOS NOR gate wired to form a 1 MHz clock. U_2 is a 4040B CMOS 12-bit binary counter used to count the clock pulses from U_4.

ADC Circuit Function

In Fig. 3, if an assumed input (0 to 13 V) to U_3 has been selected by an output from the H8-2, then the following process illustrates the method used to convert the analog voltage to a digital form:

A convert command is sent via P1, pin 15. Q_4 inverts and level-shifts this signal, which sets the binary counter U_2 to zero. It also prevents the clock U_4 from false-counting by turning Q_3 on (shorting out the input pin 10 of U_2). Q_2 is also turned on, shorting out C, and causing it to discharge. Since the voltage on U_1, pin 2, is less than that on U_1, pin 3, U_1, pin 7, goes low. As long as the convert command (P1, pin 15) is low, the ADC does nothing. As soon as the convert command goes high, both Q_3 and Q_4 are turned on. U_2 starts counting clock pulses until the voltage across C_1 is equal to the input voltage, at which time U_1, pin 7, goes high. This effectively shuts off the counter U_2. The count remains in U_2 until the convert command again resets it, and the process begins again.

A timing diagram is shown in Fig. 4 for those who wish to use a different method of control. The convert command must remain low for a minimum of 2 μs to allow the complete discharge of C_1. The other devices are controlled in under 1 μs. The minimum conversion for an input of 13 V is approximately 130 μs, and conversions cannot exceed approximately 7000 per second. Since BASIC is being used to control the ADC, speed is software limited to approximately ten ms per sample, or 100 samples per second.

Circuit Considerations

In dealing with CMOS devices, you must take some precautions. Never place any CMOS device in a plastic box or bag unless all pins are shorted together with conductive foam. Always disconnect power before installing or removing any device. All unused inputs should be grounded. Remember: static charges are CMOS killers.

The circuit design allows for all but the most unusual fault condition. Analog inputs are protected from excessive current by input resistors should signal voltage be applied while power is removed from the ADC.

U_3 address logic DA_0, DA_1 and DA_2 is inverted from the normal truth table of the 4051B because of the level shift of Q_5, Q_6 and Q_7. Input channels are shown in Fig. 3 and defined in Table 1.

DA_2	DA_1	DA_0	U_3 Pin	Defined as
0	0	0	13	7
0	0	1	14	6
0	1	0	15	5
0	1	1	12	4
1	0	0	1	3
1	0	1	5	2
1	1	0	2	1
1	1	1	4	0

Table 1. Input channels defined.

Theory of Operation

Operation of the hardware described earlier is controlled entirely by the computer. The majority of this control involves the handshaking lines between the ADC and the H8-2. Therefore the H8-2 must have jumpers A_1/A_2 and B_1/B_2 removed. For control or addressing to the ADC to be complete, J1, pin 10, must be held low. This line is the data taken line, and output data will only be transferred from the H8-2 when it is low. For data to be read into the H8-2, J1, pin 16, must change from high to low. This is the data sent line, and input data will only be transferred into the H8-2 when it goes from high to low. This line is controlled by software when connected to the device

control (P1, pin 14). This combination is used as a data valid indication.

P1, pin 13 (device ready), is used to test the ADC to make sure power is turned on. If power is removed, the ADC device ready line will be low, and a software status warns of this condition. All other handshaking lines are unused.

There are several other methods that would control the ADC; however, the one used here seems to be the simplest. Any method that satisfies both the H8-2 and ADC timing requirements may be used as long as the software is changed accordingly. You can use the timing diagram of Fig. 4 to determine the control method.

Setup

The first step in ADC operation is the preliminary calibration. Apply ±15 V to the ADC and verify that pins 1 of U_5 through U_8 are +5 V. Check pin 8 of U_1 and pin 16 of U_2 and U_3 for +15 V. Pin 14 of U_4 should also be +15 V. Verify that −15 V is available at R_2 (10k).

If the LED is lit, adjust R_2 (10k) until it dims (all inputs should be shorted together). It will never go completely off. Adjust R_3 (5k) to mid-range. Adjust R_1 (1k) for approximately 14.5 V across C_1, with P1, pin 15, high or open.

ADC Accuracy

Accurate operation of the ADC depends on several factors. If quality components are used, the best accuracy obtainable is .1 V out of 13.0 V, or .769 percent of full scale (FS). The best obtainable accuracy of an eight-bit computer is 1 bit out of 255[1], or .392 percent FS.

The reason for the difference is the method of conversion used. If an assumed 10 V were applied to the ADC input and the output scaled (by R_1) to provide 144 octal (100 decimal) counts, then an accuracy of 1 percent

C_1	.033 uF Polycarbonate or low drift silvered mica.	U_1	LM 311
R_1	1k ten turn. Bourns 260P type	U_2	4040B
R_2	10k ten turn. Bourns 260P type	U_3	4051B
R_3	5k ten turn. Bourns 260P type	U_4	4001B
Q_1	2N2907	U_5–U_8	4050B
Q_2–Q_7	2N2222		

All resistors, ¼ W. Small value capacitors are silvered mica types. Zeners are 400 mW general purpose.

Parts list.

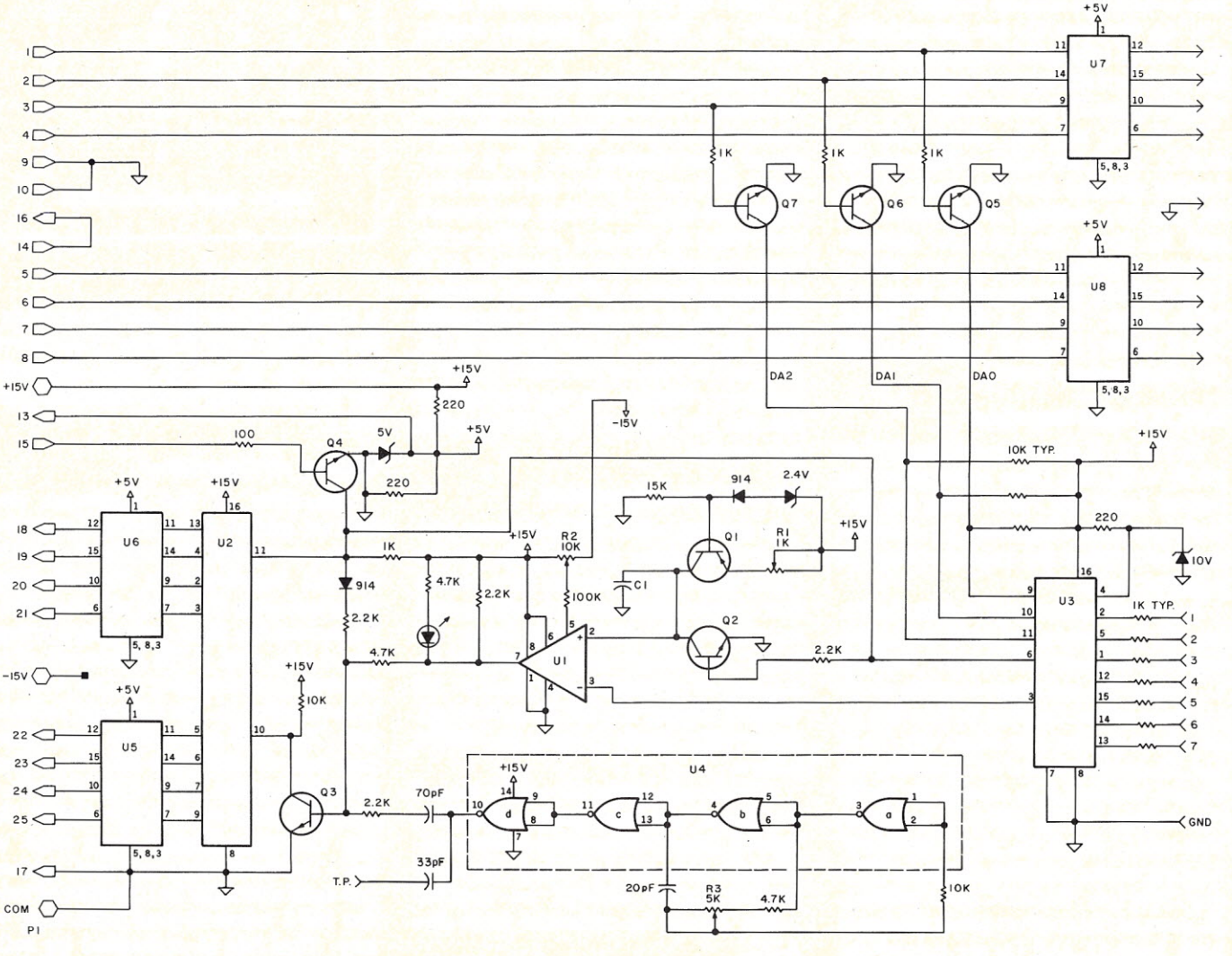


Fig. 3. Schematic diagram.

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Z80A-DMA	27.75	4007	.29	4056	2.95	4555	.75	74LS04	.39	74LS125	1.35	74LS251	1.79
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3205	3.45	4014	1.39	4071	.35	74C00	.39	74LS13	.47	74LS148	1.49	74LS266	.59
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8205	3.45	4020	1.19	4081	.35	74C20	.39	74LS26	.39	74LS158	.75	74LS293	1.95
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8259A	7.30	4035	.95	4511	1.39	74C157	2.10	74LS75	.68	74LS192	.98	74LS375	.69
8271	60.00	4037	1.95	4512	1.39	74C160	2.39	74LS76	.45	74LS193	.98	74LS377	1.95
8275	32.95	4040	1.29	4514	3.95	74C161	2.30	74LS78	.65	74LS194	1.15	74LS385	1.95
8279	10.80	4041	1.25	4515	3.95	74163	2.39	74LS83	.99	74LS195	.95	74LS386	.65
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8282	6.70	4043	.85	4519	.99	74173	2.59	74LS86	.45	74LS197	.89	74LS393	1.95
8283	6.70	4044	.85	4520	1.39	74174	2.75	74LS90	.75	74LS221	1.49	74LS395	1.70
8284	5.85	4046	1.75	4522	.99	74C175	2.75	74LS92	.75	74LS240	1.95	74LS399	2.95
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8287	6.70	4048	.99	4527	1.75	74C193	2.39	74LS95	.88	74LS242	1.95	74LS668	1.75
8288	25.40	4049	.69	4528	.99	74C195	2.39	74LS96	.98	74LS243	1.95	74LS670	2.29

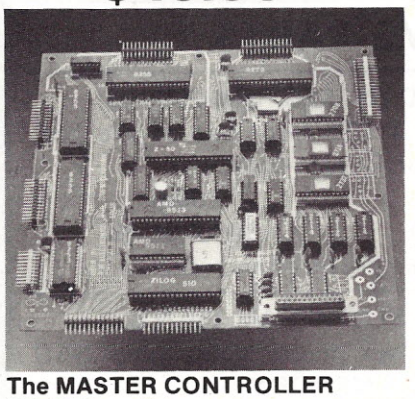
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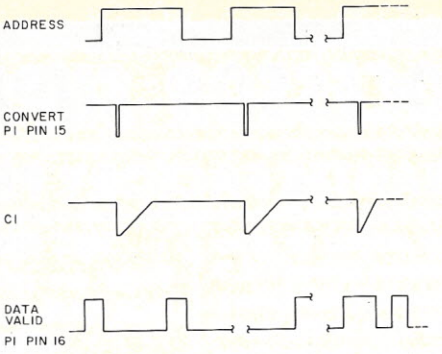


Fig. 4. Relative ADC timing.

(1 count out of 100) would result. Since the maximum input to the ADC is 13 V, the result is .769 percent. Note that the full eight bits are not used. (100 decimal = 01100100 binary, and 130 decimal = 10000010 binary.

Software Description

To evaluate and calibrate the ADC, connect it to the H8-2 as shown in Figs. 2 and 3. Use the process in Table 2 to check the operation of the ADC. In the software command mode, ↑ is defined as a carriage return.

The H8-2 is now ready to send and receive data. The ADC is set to read the internal reference (10 V).

*PRINT PIN (0) ↑

As soon as the carriage return (↑) is hit, the ADC is reset and then reads the internal 10-volt reference. The value read by the H8-2 will be printed on the system terminal. The value read will be a random value between 0 and 255. Again type:

* PRINT PIN(0) ↑
* OUT 1,21:OUT 1,53 ↑

The value printed on the terminal should be close to 100. The Heath software automatically returns the binary value from the H8-2 in decimal form. Because of this, the full eight bits, i.e., 11111111, are not used, and no further mathematical conversions are required. To read 10 V on the terminal, use the following:

* PRINT PIN(0)/10
* OUT 1,21:OUT 1,53 ↑

The value printed on the terminal should be the same as before, but with a decimal point.

Software Calibration

With the preliminaries out of the way, the ADC is ready to calibrate. For the best linearity and accuracy, you should use a frequency counter to adjust the clock. R_3 (5k) should be adjusted for 1 MHz, ±1 kHz. If no counter is available, adjust R_3 to center range. Unless component values greatly deviate from those specified, an approximately ±3 percent FS accuracy will result. For calibration purposes, short all of the inputs together and to ground. Use the software program in Listing 1 to adjust the ADC.

As soon as the program starts running, two values will appear on the terminal. Adjust the first number to zero using R_2 and adjust the second number to 10.0 using R_1. If the LED is brightly lit, the ADC is not adjusted correctly. Readjust R_2 until the LED dims. Carefully adjust R_2 further until the first number reads zero. Readjust R_1 (10 V) if necessary.

The ADC is now calibrated to the internal 10-V reference. If greater accuracy is required, use a variable precision 10-V power source on one of the unused channels or measure the actual value of the internal 10 V and adjust R_1 to read that value on the terminal.

Linearity can be checked using an external variable voltage source. You can make a spot check by connecting

Program listing.

```
10 REM *** ADC SOFTWARE DRIVER ***
20 REM  *** VER. 1.3.1  ** OCT. 10,1979  ** BY LARRY T. WIER  ***
30 REM  *** BELLEVUE, WA. 98007 ***
40 REM  *** WRITTEN FOR THE H8-2 PORT 1  *** ADDRESS (0) AND (1)  ***
50 REM  *** HEATH EXTENDED BASIC VER. 10.05  ***
60 O$="                ":O$=O$+O$+O$+O$
70 DEF FN K$(X$)=LEFT$(O$,35-INT(LEN(X$)/2))+X$
80 T1$="**********":T$="* ADC DRIVER *"
90 PRINT FN K$(T1$):PRINT FN K$(T$):PRINT FN K$(T1$):PRINT :PRINT
100 PRINT TAB(5)"BE SURE THE H8-2 PORT USED IS CONFIGURED CORRECTLY AND THAT"
110 PRINT "IT IS JUMPERED FOR ADDRESSES (0) AND (1).  IF THE PORT ADDRESS IS"
120 PRINT "DIFFERENT ALL 'OUT' AND 'PIN' STATEMENTS MUST BE CHANGED TO "
130 PRINT "AGREE WITH THE PORT ADDRESSING."
140 PRINT :PRINT "PRESS ANY KEY TO CONTINUE":PAUSE
150 DIM D(7),E(7)
160 REM  *** SET-UP PARALLEL I/O AND CHECK ADC OPERATION ***
170 OUT 1,64:OUT 1,78:OUT 1,53
180 FOR X=0TO 7
190 GOSUB 8000
195 D(X)=A
```

* OUT 1,64 ↑	Resets the H8-2
* OUT 1,78 ↑	H8-2 in the command mode.
* OUT 1,53 ↑	Turns on xmtr and rcvr[2].
* OUT 0,0 ↑	Select ADC channel 0.
* OUT 1,21 ↑	Sets H8-2 pin 12 high.
* OUT 1,53 ↑	Resets H8-2 pin 12 low.
* PRINT PIN(0) ↑	
* PRINT PIN(0) ↑	
* OUT 1,21:OUT 1,53 ↑	Read internal 10 V ref.
*PRINT PIN(0)/10 ↑	
*OUT 1,21:OUT 1,53 ↑	

Table 2.

```
4000 REM *** CALIBRATION ROUTINE ***
4010 OUT 1,64
4015 OUT 1,78
4020 OUT 1,53
4030 OUT 0,1
4040 OUT 1,21:OUT 1,53
4050 A=PIN(0):PRINT A/10
4060 OUT 0,0
4070 OUT 1,21:OUT 1,53
4080 A=PIN(0):PRINT A/10
4090 FOR I=1 TO 300:NEXT I
5000 GOTO 4030
```

Listing 1. Calibration routine.

one of the inputs to the +5 V at pin 1 of U_5 or U_6. If an external voltage source is to be used, connect it to one of the seven input lines. Change line 4060 to reflect the correct port address, i.e., 4060 OUT 0,#, where # is the port number (1 to 7). Port 0 is internally connected to the 10-V reference.

Adjust the output of the precision source to +10 V. If the terminal does not read 10.0, adjust R_1 until it does. Set the precision source to 0.1 V. If the terminal does not read 0.1, adjust R_2 until it does. Check linearity by plotting input voltage versus the output printed on the terminal. The values should not be different by more than ±0.1 V (±1 bit).

Program Development

The main object of the ADC is to freely select any analog input port at any given time and have the ADC automatically complete an A to D conversion. This is similar to the way random access memory functions. In the case of the ADC, D_0 through D_2 (data output) becomes the address (DA_0–DA_2) of the ADC port selection.

An H8 read function tells the ADC

```
200 NEXT X
210 FOR X=0TO 7
220 E(X)=D(X)
230 NEXT X
240 FOR X=0TO 7
245 D(X)=A
250 GOSUB 8000
260 NEXT X
270 FOR X=0TO 7
280 IF D(X)>13.3THEN PRINT "CHAN. NO.  ";X;"OVER RANGE!!!":PRINT CHR$(7)
290 IF D(X)>=E(X)THEN E(X)=D(X)
300 IF D(X)<=1.0THEN GOSUB 8200
310 NEXT X
320 PRINT
325 PRINT TAB(5)"THE ADC APPEARS TO BE FUNCTIONING NORMALLY.  NO FURTHER PRINT
OUT"
330 PRINT "WILL BE MADE UNLESS AN ERROR HAS OCCURED.  WHEN AN ERROR IS "
340 PRINT "DETECTED THE TERMINAL BELL ALONG WITH A REMOTE WARNING BELL (IF USED
)"
350 PRINT "WILL SOUND.":PRINT
360 PRINT TAB(5)"YOU MAY NOW CLEAR THE SCREEN IF A CRT TERMINAL IS USED."
370 PAUSE 300
380 GOTO 8300
390 END
8000 REM  *** ADC READ SUBROUTINE ***
8010 A=PIN(0):OUT 1,21:OUT 1,53:A=PIN(1):IF A<>151THEN 8100
8020 A=PIN(0)/10:OUT 1,21:OUT 1,53
8030 RETURN
8100 REM *** STATUS CHECKING ***
8110 IF A=133THEN PRINT CHR$(7)"ADC IS NOT POWERED OR H8-2 JUMPERS MISSING.":ST
OP
8120 IF A=5THEN PRINT CHR$(7)"I/O PORT NOT READY":STOP
8130 IF A=40THEN PRINT CHR$(7)"OVERRUN AND FRAMING ERRORS HAVE OCCURRED":STOP
8140 IF A=10THEN PRINT CHR$(7)"A PARITY ERROR HAS OCCURRED":GOTO 8010
8150 IF A=16THEN PRINT CHR$(7)"AN OVERRUN ERROR HAS OCCURED":GOTO 8010
8160 IF A=32THEN PRINT CHR$(7)"A FRAMING ERROR HAS OCCURED":GOTO 8010
8170 PRINT
8180 PRINT "ADC STATUS ERROR.  AN ERROR OF ";A;"HAS BEEN READ.  REFER TO THE H8
-2"
8190 PRINT "OPERATION MANUAL FOR PROBLEM DEFINITION.":PRINT CHR$(7):STOP
8200 REM  *** LOW VALUE CHECK (STATUS) ***
8210 IF D(X)<-.5THEN PRINT "IS CHAN. NO. ";X;"IN USE?"::LINE INPUT "  (YES OR NO
)  ";Z$
8220 IF LEFT$(Z$,2)="NO"THEN D(X)=0:RETURN
8230 IF LEFT$(Z$,2)="YE"THEN 8250
8240 PRINT CHR$(7)"PLEASE INPUT THE CORRECT COMMAND":GOTO 8210
8250 PRINT CHR$(7)"ADC CHANNEL FAILURE.":::LINE INPUT "   DO YOU WISH TO CONTINU
E? (YES OR NO)  ";Z$
8260 IF LEFT$(Z$,2)="NO"THEN STOP
8270 IF LEFT$(Z$,2)="YE"THEN D(X)=A:RETURN
8280 PRINT CHR$(7)"PLEASE INPUT THE CORRECT COMMAND":GOTO 8250
8290 RETURN
8300 REM *** OUTPUT AND RESULT CHECK ***
8310 X=0:IF D(X)=0THEN 8350
8320 OUT 0,0:GOSUB 8000
8330 D1=A:IF D1<9.8OR D1>10.2THEN PRINT CHR$(7)"REF VOLTAGE NEEDS ADJUSTMENT"
8350 X=1:IF D(X)=0THEN 8400
8360 OUT 0,1:GOSUB 8000
8370 D2=A:IF D2<=5.0THEN 9000
8400 X=2:IF D(X)=0THEN 8450
8410 OUT 0,2:GOSUB 8000
8420 D3=A:IF D3<=5.0THEN 9100
8450 X=3:IF D(X)=0THEN 8500
8460 OUT 0,3:GOSUB 3000
8470 D4=A:IF D4<=4.0THEN 9200
8500 X=4:IF D(X)=0THEN 8550
```

More

```
7000  PRINT TAB(27)"ADC POLLING TEST"
7005  PRINT:PRINT
7010  DIM D(7)
7020  REM *** SET-UP H8-2 PARALLEL I/O ***
7030  OUT 1,64:OUT 1,78:OUT 1,53
7040  FOR X=0 to 7
7050  GOSUB 8000
7060  NEXT X
7070  FOR X=0 to 7
7080  PRINT"CHAN. NO. ";X;"  ";D(X)
7090  NEXT X
7100  PAUSE 10
7110  PRINT:PRINT:GOTO 7040
7120  STOP
8000  OUT 0,X
8010  A=PIN(0):OUT 1,21:OUT 1,53:A=PIN(1):IF A <> 151 THEN 8050
8020  D(X)=PIN(0)/10:OUT 1,21:OUT 1,53
8030  IF D(X)>=13.3THEN PRINT"CHAN. NO. ";X;"OVER RANGE !!":PRINT
8040  RETURN
8050  PRINT CHR$(7)"OUTPUT DEVICE NOT POWERED!!!"
8060  STOP
```

Note: Line 7100 is used only for visual delay. It probably would not be necessary in an actual program.

Listing 2. ADC polling test.

1 OUT 0,0	Select port 0
2 PIN(0)	Read data (previous valid data)
3 OUT 1,21:OUT 1,53	Data valid (line 1)
4 OUT 0,1	Select port 1
5 PIN(0)	Read data (from line 1)
6 OUT1,21:OUT 1,53	Data valid (line 4)
7 OUT 0,2	Select port 2
8 PIN(0)	Read data (from line 4)
9 OUT 1,21:OUT 1,53	Data valid (line 7)
10 OUT 0,3	Select port 3
11 PIN(0)	Read data (from line 7)
12 OUT 1,21:OUT 1,53	Data valid (line 10)

Table 3.

to read; software program timing tells the H8-2 when data is valid; and when this is complete, the data output lines are then free to control some other device based on the data just read. In light of this process, the actual ADC control function could be a subroutine with only the port select and the data value contained in the body of the program.

For example, assume the ADC were to be used in a polling mode, i.e., select channel 1 through 7 in sequence. The program to produce this function is shown in Listing 2. If you want a true random access port selection, use Listing 3.

Many different possibilities exist in the random access mode. It is not necessary to use these exact program-

Listing continued.

```
8510 OUT 0,4:GOSUB 8000
8520 D5=A:IF D5<=2.0THEN 9300
8550 X=5:IF D(X)=0THEN 8600
8560 OUT 0,5:GOSUB 8000
8570 D6=A:IF D6<=3.5THEN 9400
8600 X=6:IF D(X)=0THEN 8650
8610 OUT 0,6:GOSUB 8000
8620 D7=A:IF D7<=3.5THEN 9500
8650 X=7:IF D(X)=0THEN 8310
8660 OUT 0,7:GOSUB 8000
8670 D8=A:IF D8<=2.1THEN 9600
8680 GOTO 8310
9000 REM *** ROUTINE FOR TURNING ON AND CHECKING FRONT YARD LIGHTS ***
9010 N=0
9020 OUT 0,101:N=N+1
9030 GOSUB 8000
9040 IF N<4THEN 9060
9050 IF N>3THEN PRINT CHR$(7)"FRONT YARD LAMP NOT WORKING":OUT 0,200:GOTO 8400
9060 GOSUB 8000
9070 IF A<=5.0THEN 9020
9080 GOTO 8400
9100 REM *** ROUTINE FOR TURNING ON AND CHECKING REAR YARD LIGHTS ***
9110 N=0
9120 OUT 0,112:N=N+1
9130 GOSUB 8000
9140 IF N<4THEN 9160
9150 IF N>3THEN PRINT CHR$(7)"REAR YARD LAMP NOT WORKING":OUT 0,200:GOTO 8450
9160 GOSUB 8000
9170 IF A<=5.0THEN 9120
9180 GOTO 8450
9200 REM *** FURNACE TIMER CONTROL (24 HR ON/OFF SETTING) ***
9210 OUT 0,123
9220 GOSUB 8000
9230 IF A>=4.1THEN 8500
9240 IF A<=4.0THEN 8600
9300 REM *** FURNACE CONTROL ***
9310 OUT 0,134
9320 GOSUB 8000
9330 IF A<=2.0THEN PRINT CHR$(7)"GAS(OIL) TO FURNACE HAS BEEN CUT OFF":OUT 0,20
0:GOTO 8550
9400 REM *** HEAT PUMP POWER MONITOR ***
9410 OUT 0,145
9420 GOSUB 8000
9430 IF A<=10.0THEN PRINT CHR$(7)"POWER TO HEAT PUMP HAS FAILED":OUT 0,200:GOTO
8600
9500 REM *** INSIDE LOW TEMPERATURE MONITOR WHEN HEAT TIMER IS OFF ***
9510 OUT 0,156
9520 GOSUB 8000
9530 IF A<=3.5THEN 8500
9540 GOTO 8650
9600 REM *** BURGLAR ALARM MONITOR ***
9610 OUT 0,167
9620 GOSUB 8000
9630 IF A<=2.1THEN PRINT CHR$(7)"ALARM NOT SET OR POWER IS OFF":OUT 0,200:GOTO
8310
9900 REM *** ADC PROGRAM ERROR ROUTINE ***
9910 PRINT :PRINT CHR$(7)
9920 PRINT
9930 PRINT "IF THE PROGRAM HAS DROPPED TO THIS LEVEL ONE OR MORE OF THE 'OUT' O
R 'PIN'"
9940 PRINT "STATEMENTS IS INCORRECTLY PROGRAMMED."
9950 END
```

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ming sequences; the only important point in programming is to allow enough time for the switch U_3 to settle before reading. The best sequence is shown in Table 3.

Note that the data read into the CPU is always the previous channel valid data (OUT 1,21:OUT 1,53). The reason for this is that data is loaded into a hardware buffer before being sent to the CPU. Because of this, it appears that the data is always one ADC channel delayed. It is not delayed as far as the ADC is concerned, but one additional PIN(0) command must be made to clear out the buffer before a new data value is loaded.

The subroutine in Listing 4 automatically aligns (clears out) all data read by the ADC/H8-2 combination. By using the subroutine, data will always be aligned with the channel when using either polling or random addressing schemes.

Summary

Although the ADC described here requires many components, it is still less expensive than the newer, so-called single ADC ICs being developed today. Some of these new devices cost around $15. A multichannel ADC using these devices costs between $30 and $40 and occupies about half the space. Software requirements are approximately the same.

Even though this ADC is limited to input values from 0 to 13 V dc, almost any function can be "signal-conditioned" to a value between 0 and 10 V. The examples used in the software section are part of an experimental control system.■

References

1. Heath software section 0, Appendix E, number conversion.
2. H8-2 operation manual, 8251 operation.


```
10  PRINT TAB(15)"A TEST PROGRAM FOR RANDOM ADC ACCESS"
20  DIM D (7)
30  REM *** SET-UP H8-2 ***
40  OUT 1,64:OUT 1,78:OUT 1,53
50  OUT 0,0:GOSUB 500
60  D1 = A
70  IF D1 <9.9 OR D1 > 10.1 THEN PRINT "10 VOLT REF NEEDS ADJUSTMENT"
80  REM *** ADDITIONAL OR DIFFERENT PROGRAMS CAN BE
90  REM *** PUT INTO THESE LOCATIONS
100  REM ***
110  OUT 0,1:GOSUB 500
120  D2 = A:IF D2 <=5.5 THEN 600
130  REM *** ADDITIONAL OR DIFFERENT PROGRAMS CAN
140  REM *** BE PUT INTO THESE LOCATIONS
150  OUT 0,7:GOSUB 500
160  D3 = A:IF D3 >= 9.9 THEN GOSUB 700
 '
 '
 '
500  REM *** ADC READ SUBROUTINE ***
510  A = PIN(0):OUT 1,21:OUT 1,53:A = PIN(1):IF A <>151 THEN 800
520  A = PIN(0)/10:OUT 1,21:OUT 1,53
530  IF A > 13.3 THEN PRINT CHR$(7)"WARNING-OVER RANGE":PRINT:PRINT
540  RETURN
 '
600  REM *** ROUTINE FOR TURNING ON AND CHECKING YARD LIGHTS ***
610  N = 0
620  OUT 0,201:N = N + 1
630  OUT 0,1:GOSUB 500:IF A<5.5 OR N<3 THEN 620
640  IF N>3 THEN PRINT"YARD LIGHT NOT WORKING":N = 0:GOTO 130
 '
 '
700  REM *** SUBROUTINE FOR HOUSE HEATING ***
710  OUT 0,207
720  OUT 0,6:GOSUB 500
730  IF A<>3.0 THEN PRINT CHR$(7)"CHECK FURNACE"
740  RETURN
 '
 '
800  REM *** ROUTINE FOR H8-2 STATUS CHECKING ***
810  IF A = 133 THEN PRINT CHR$(7)"DEVICE NOT READY":STOP
820  IF A = 5 THEN PRINT CHR$(7)"I/O NOT READY":STOP
```

Listing 3. Random ADC access test.

```
8000  REM *** ADC READ SUBROUTINE *** See line 8000, Listing 2
8010  A = PIN(0):OUT 1,21:OUT 1,53
8020  A = PIN(0)/10:OUT 1,21:OUT 1,53
8030  IF A>13.3 THEN PRINT"OVER RANGE":PRINT
8040  RETURN
```

Listing 4. ADC Read subroutine.

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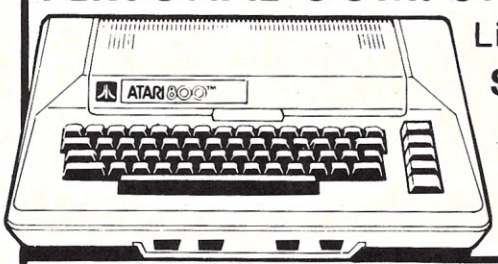
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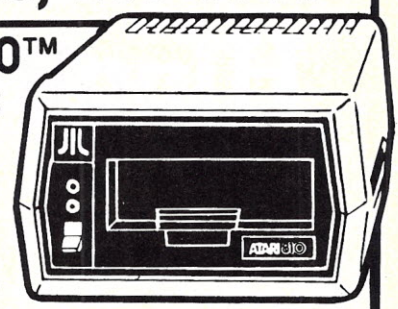
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Get the jump on faulty memory components before they cause problems.

Hippity-Hop Memory Test

By Jim Work

One day at work, I received a frantic phone call from one of our programmers. She was trying to create a FORTRAN source file with the CP/M editor, and was having problems. In the blank area to the left of one of the lines there was a control-@ instead of a space. She killed the line, entered it again, and the same control character showed up in the same place. When the line was killed and we looked at the surrounding statements, we found that the offending character had moved down to the next line.

The problem was obviously a bad memory bit. A space is 20 hex and a control-@ is a null or 0 hex. The sixth bit was being changed from a one to a zero. I had installed a repertoire of seven memory tests on the system. I tried all of these tests to find the bad bug, but not one of them would locate the problem.

As it turned out, the problem was due to a pattern sensitivity rather than a hard failure. To locate the problem, I had to swap boards around to different address locations to find the bad board, and then I had to swap bugs around to find the bad one. Since this is a frustrating way to fix a computer, I needed a better memory test.

Memory is one of the weakest parts of most computer systems. In critical industrial environments, memory tests are routinely run at least once a week, and in some cases, every morning. These tests will hopefully detect faulty memory components before they cause problems.

Most memory chips are designed so that the cells, or individual bit storage locations, are arranged in a matrix. For example, the 2102A is a one-bit-wide-by-1024-words-deep static RAM. Since this chip holds 1024 words, it has ten address lines, and these address lines are broken up into two groups of five. The lower group of five bits is used to select the row in the matrix, and the higher group of five bits is used to select the column. The intersection of row and column defines the physical location of the given address. Assuming the chip has been selected, the data bit is either written to or read from that location, depending on whether the read/write line is high or low.

There is little doubt that static memory is more reliable than dynamic memory. But static memory, which costs more and uses more power, has its share of problems.

Environment, Circuitry, Chips

Memory problems can be due to a poor environment, faulty support circuitry or bad memory chips.

Environment—If a memory chip has marginal speed characteristics, a low supply voltage can slow it down enough to cause problems. If a memory chip is running hot, it may slow down or develop lead-bonding problems. Noise on supply, ground, data, control or address lines may result in bad data.

Support circuits—Bad line drivers and receivers will result in bad data. Bad address decoders may result in the data for two words being written to and read from the same location, one word being written to more than one location, or, at least, the inability to address all of the memory. Problems in the complex circuitry required for the support of dynamic memory can cause timing problems that may be difficult to locate.

Memory chips—Most memory chip problems can be divided into the following categories.

First is pattern sensitivity. All memory cells in a memory chip are arranged in a matrix. If there is leakage between adjacent cells, the data in one cell may affect the data in its neighbor. Pattern errors are generally associated with dynamic memories, but they can crop up in static memory chips as well.

This type of error is difficult to detect with most memory tests. Two good examples of dynamic memory chips are two one-bit-by-8192-word RAMs—the 2108 and the 2109. The former has four 32 by 128 bit matrices, and the latter has two 64 by 128 bit matrices. A given address in the 2108 may not have the same neighbors (in terms of address) as the 2109.

Since pattern sensitivity is caused by the interaction of neighbors, it is impossible for a test that is optimized for one chip to run successfully on one of a different configuration. The test presented in this article is designed to run on any memory chip. Since nothing is free, the cost is time.

Second is soft errors. The most frustrating and expensive problem for

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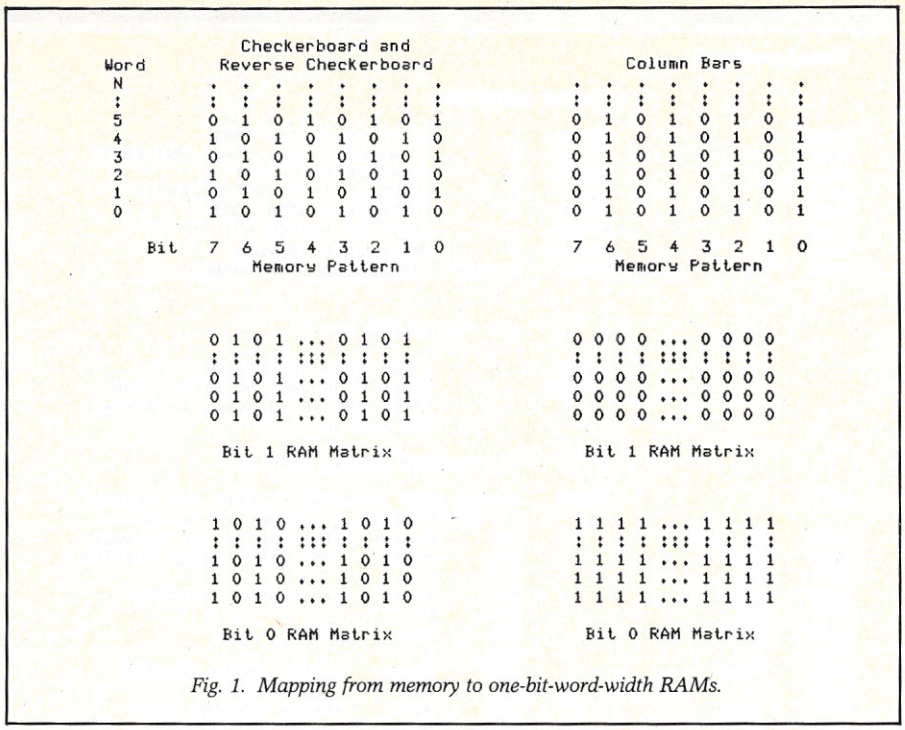


Fig. 1. Mapping from memory to one-bit-word-width RAMs.

memory chip manufacturers is the alpha particle. Despite extraordinary efforts, much of the materials used in the production of semiconductor circuits is subject to very slight radioactive contamination. This is not a problem with bipolar circuits, but a stray alpha particle (a helium nucleus) can change the state of an MOS memory cell, data line or sense amplifier. The greater the circuit density on the chip, the greater the probability that an alpha particle will cause a problem.

This error is a random event. That is, it will occur once and then go away. As a result, there is no test that can be used to detect or predict such a problem. As greater circuit densities are achieved, on-chip error detecting and correcting circuits will have to be provided by the semiconductor manufacturers.

Third are shorts and opens, which generally result in a stuck bit or series of bits. This is the most common memory problem, and almost any memory test will find the offending bit or bits.

Fourth is speed. A memory cell may not quickly settle down after a write operation, and, as a result, a read in the next cycle may produce bad data. When a read is performed, a sense amplifier may be slow to respond to the change in data, thus causing a bad read.

Fifth is sleeping sickness. Dynamic memory cells have a specified time for which they are supposed to remember what has been written to them before refresh becomes necessary. It is possible for the data to leak away before the specified hold time. A test for this problem requires special equipment to control the length of the refresh cycle.

Common Memory Tests

You can use one of a seemingly unlimited number of memory tests. The problem is to pick the right one.

The most common is the all ones-all zeros test. This first fills memory with all ones, and then checks to make sure that the data is still all ones. If an error is noted the address of the bad word and the bad bit information is printed out or displayed on the terminal. This procedure is then repeated with zeros. The only error that this test will find is a stuck bit.

Another common test is the nondestructive fast complement and check test. A word is read from memory. It is complemented, and the complement is written back into memory and stored in one of the CPU's registers. The complemented data is then read from memory and compared to the complemented word in the register. Any errors are noted and printed out as above. This process is then repeated to reconstruct the original word. The address pointer is then incremented and the process is repeat-

Hippity-Hop memory test.

```
                ;****************************************
                ;*                                      *
                ;*       HIPPITY-HOP MEMORY TEST        *
                ;*              VERSION 1.1             *
                ;*                                      *
                ;* BY JIM WORK                          *
                ;****************************************
                ;
                ;THIS IS A MEMORY TEST THAT WILL TEST ALL BITS
                ;AND THE INTERACTION BETWEEN THE BITS AS WELL
                ;AS ADDRESSING PROBLEMS.
                ;
                ;ALL NUMERICAL DATA ENTERED FROM THE KEYBOARD IS IN
                ;HEXADECIMAL.  THE RANGE OF THE TEST IS ENTERED AS
                ;[LOW ADDRESS],[HIGH ADDRESS].  ONE DELAY PERIOD IS
                ;ABOUT ONE MILLISECOND, USING A Z-80 WITH A 4 MHZ
                ;CLOCK AND NO WAIT STATES.  THE GREATEST NUMBER OF
                ;DELAY PERIODS IS FFFF (64K).  THE GREATEST CHIP
                ;DEPTH IS FFFF (64K) WORDS.
                ;
                ;AS THE TEST PROGRESSES, THE BACKGROUND HALF BYTE
                ;WILL BE PRINTED EVERY SO OFTEN.  THIS WILL LET YOU
                ;KNOW THAT THE SYSTEM IS STILL ALIVE.
                ;
                ;A CONTROL-C WILL STOP THE TEST AND REBOOT THE
                ;SYSTEM.
                ;
                ;WHEN AN ERROR IS ENCOUNTERED, THE FOLLOWING
                ;ARE PRINTED OUT.
                ; 1.  THE ADDRESS OF THE BAD BYTE.
                ; 2.  THE TEST BYTE.
                ; 3.  IN THE BAD BYTE, THE GOOD BITS ARE
                ;     REPRESENTED BY "G" AND THE BAD ONES
                ;     BY "B".
                ;
                ;
                ;       <<< CONSTANTS >>>
                ;
000D            CR=     0DH     ;CARRIAGE RETURN
000A            LF=     0AH     ;LINE FEED
0400'           RAM=    0'+400H ;START OF TEMPORARY STORAGE
                ;
                ;THE FOLLOWING IS A LIST OF CONSTANTS USED
                ;BY THE NORTH STAR HORIZON.  IF YOU HAVE
                ;ANOTHER COMPUTER, YOU MAY HAVE TO CHANGE
```

More

ed. This test is very good for speed and stuck bit problems, but the chance of it detecting a pattern problem is scant at best.

The sequential number test is very good for detecting address decoding problems, but its ability to check for pattern problems is limited.

There are many test patterns that work well in testing chips when the specified pattern is written into the chip. But frequently, these patterns will not be retained when they are generated at the word level and then written into the chips. This results in the loss of the original test pattern.

For example, a test that was originally designed for core memories is the bar column test. This test is limited in that it only checks for column-to-column leakage and refresh problems in memories that are greater than one bit wide, but they are of little use with the RAM most frequently used in microcomputers: the one-bit-wide RAM. When the bar column pattern is mapped into one-bit-wide RAMs, it becomes an all ones-all zeros test (see Fig. 1).

Another common test, designed for

Listing continued.

```
                        ;THESE CONSTANTS.
                        ;
0003                    CONSP=  3       ;CONSOLE STATUS PORT
0001                    CTBNE=  1       ;CONSOLE TRANS. BUFF. NOT EMPTY
0002                    CONDP=  2       ;CONSOLE DATA PORT
0002                    CIBE=   2       ;CONSOLE INPUT BUFFER EMPTY
0005                    PRNSP=  5       ;PRINTER STATUS PORT
0001                    PTBNE=  1       ;PRINTER BUFFER NOT EMPTY
0004                    PRNDP=  4       ;PRINTER DATA PORT
E800                    BOOT=   0E800H  ;SYSTEM BOOT-UP ADDRESS
                        ;
                        ;
                        ;       <<< PSEUDO-OPS >>>
                        ;
                        .PREL           ;THIS IS A RELOCATABLE FILE.
                        .I8080          ;8080 CODE ONLY SO WE CAN RUN
                                        ;THE TEST ON AN 8080, AN 8085,
                                        ;OR A Z-80.
                        ;
                        ;       <<< PROGRAM BEGINS HERE >>>
                        ;
0000'                   INIT:   ;THESE NEXT 12 LINES OF CODE ARE NEEDED
                                ;IF THE PROGRAM IS TO BE PUT IN ROM.
0000'  21 0400'                 LXI     H,RAM   ;INITIALIZE THE STORAGE
0003'  3665                     MVI     M,101   ;ONLY 100 ERRORS PRINTED
0005'  23                       INX     H
0006'  3655                     MVI     M,55H   ;BACKGROUND PATTERN
0008'  23                       INX     H
0009'  3601                     MVI     M,1     ;FLAG
000B'  23                       INX     H
000C'  3640                     MVI     M,64    ;LINE LENGTH COUNTER
000E'  23                       INX     H
000F'  3600                     MVI     M,0     ;ERROR HEADING FLAG
0011'  23                       INX     H
0012'  3600                     MVI     M,0     ;PRINTER FLAG
0014'  21 02C1'         HRWEGO: LXI     H,MSG1  ;SAY HELLO.
0017'  CD 0259'                 CALL    TYPE
001A'  CD 029D'                 CALL    KBD
001D'  FE59                     CPI     'Y'
001F'  C2 0027'                 JNZ     ..NP    ;JUMP IF NO PRINTER.
0022'  21 0405'                 LXI     H,PRNT
0025'  36FF                     MVI     M,0FFH
0027'  CD 023C'         ..NP:   CALL    CRLF
002A'  31 0422'         START:  LXI     SP,STACK;SET UP THE STACK.
002D'  21 0306'                 LXI     H,MSG2  ;SIGN ON MESSAGE.
0030'  CD 0259'                 CALL    TYPE
0033'  0602             GETADD: MVI     B,2     ;GET THE LIMITS OF THE TEST.
0035'  21 0000          ..GA:   LXI     H,0
0038'  CD 0170'                 CALL    GETHEX
003B'  79                       MOV     A,C
003C'  CD 0246'                 CALL    CHK
003F'  EB                       XCHG
0040'  05                       DCR     B       ;TWO ADDRESSES YET?
0041'  C2 0035'                 JNZ     ..GA    ;START=>DE  END=>HL
0044'  E5               GETDEL: PUSH    H
0045'  21 0312'         ..GD:   LXI     H,MSG3  ;GET DELAY.
0048'  CD 0259'                 CALL    TYPE
004B'  21 0000                  LXI     H,0
004E'  CD 0170'                 CALL    GETHEX  ;GET HEX CHARACTER
0051'  79                       MOV     A,C     ;PUT NON-HEX CHAR IN ACC
0052'  FE0D                     CPI     CR      ;IS IT A CARRIAGE RETURN?
0054'  C2 0045'                 JNZ     ..GD    ;IF NOT, TRY AGAIN.
0057'  CD 023C'                 CALL    CRLF
005A'  22 040A'                 SHLD    DEL     ;(DEL)=# OF DELAY PERIODS.
005D'  21 0336'         GETDEP: LXI     H,MSG4  ;GET CHIP DEPTH.
0060'  CD 0259'                 CALL    TYPE    ;THIS IS JUST LIKE GETDEL:
0063'  21 0000                  LXI     H,0
0066'  CD 0170'                 CALL    GETHEX
0069'  79                       MOV     A,C
006A'  FE0D                     CPI     CR
006C'  C2 005D'                 JNZ     GETDEP
006F'  CD 023C'                 CALL    CRLF
0072'  44                       MOV     B,H
0073'  4D                       MOV     C,L
0074'  22 0408'                 SHLD    INC     ;(INC)=CHIP DEPTH.
0077'  EB                       XCHG
0078'  22 0406'                 SHLD    END     ;(END)=UPPER LIMIT OF TEST.
007B'  EB                       XCHG
007C'  E1                       POP     H
007D'  3E4F                     MVI     A,'O'   ;REASSURE THE FOLKS.
007F'  CD 0277'                 CALL    SEND
0082'  3E4B                     MVI     A,'K'
0084'  CD 0277'                 CALL    SEND
0087'  CD 0166'                 CALL    SETUP   ;SET LIMITS FOR THIS PART.
008A'  E5               SOFT:   PUSH    H
008B'  21 0403'                 LXI     H,TEMP0
008E'  3640                     MVI     M,64    ;RESTORE LINE LENGTH.
0090'  21 0362'                 LXI     H,MSG5
0093'  CD 0259'                 CALL    TYPE
0096'  E1                       POP     H
0097'  E5                       PUSH    H
0098'  7C                       MOV     A,H
0099'  CD 0266'                 CALL    WRIT2   ;SEND 'FROM' ADDRESS.
009C'  7D                       MOV     A,L
009D'  CD 0266'                 CALL    WRIT2
00A0'  21 036F'                 LXI     H,MSG6
00A3'  CD 0259'                 CALL    TYPE
```

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Listing continued.

```
00A6'  7A                    MOV     A,D
00A7'  CD 0266'              CALL    WRIT2   ;SEND 'TO' ADDRESS.
00AA'  7B                    MOV     A,E
00AB'  CD 0266'              CALL    WRIT2
00AE'  CD 023C'              CALL    CRLF
00B1'  E1                    POP     H
00B2'  44              STRTST: MOV     B,H
00B3'  4D                    MOV     C,L
00B4'  C5              BCKGND: PUSH    B       ;PUT IN BACKGROUND PATTERN.
00B5'  E5                    PUSH    H
00B6'  CD 0191'              CALL    FILLIT  ;(BACKGROUND=REFERENCE BYTE)
00B9'  CD 01B1'              CALL    DELAY
00BC'  E1                    POP     H
00BD'  E5                    PUSH    H
00BE'  CD 019C'              CALL    CHKIT   ;IS THE BACKGROUND STILL OK?
00C1'  E1                    POP     H
00C2'  C1                    POP     B
00C3'  CD 02B2'        TEST: CALL    STOP    ;DO WE WANT TO QUIT?
00C6'  E5                    PUSH    H
00C7'  E5                    PUSH    H
00C8'  60                    MOV     H,B     ;MOVE TEST POINTER TO HL.
00C9'  69                    MOV     L,C
00CA'  3A 0401'              LDA     REF     ;GET BACKGROUND BYTE.
00CD'  2F                    CMA             ;COMPLEMENT IT
00CE'  77                    MOV     M,A     ;WRITE IT AS THE TEST BYTE
00CF'  E5                    PUSH    H
00D0'  C5                    PUSH    B
00D1'  CD 01B1'              CALL    DELAY   ;WAIT FOR LEAKAGE.
00D4'  C1                    POP     B
00D5'  E1                    POP     H
00D6'  CD 0156'              CALL    CHKOMP  ;CHECK IT.
00D9'  E1                    POP     H
00DA'  CD 01AB'        ..INLP: CALL    SAME    ;LOOKING AT THE COMP WORD?
00DD'  CA 00EA'              JZ      ..SM    ;IF SO, LETS CHECK IT.
00E0'  C5                    PUSH    B       ;SAVE THE WRITING POINTER.
00E1'  3A 0401'              LDA     REF
00E4'  46                    MOV     B,M
00E5'  B8                    CMP     B       ;CHECKIT
00E6'  C4 01D9'              CNZ     ERROR
00E9'  C1                    POP     B       ;GET THAT POINTER BACK.
00EA'  CD 0156'        ..SM: CALL    CHKOMP  ;CHECK THE TEST WORD.
00ED'  CD 01CD'              CALL    HILO
00F0'  D2 00DA'              JNC     ..INLP
00F3'  22 040C'              SHLD    BGN     ;A NEW BEGINNING!
00F6'  E1                    POP     H
00F7'  CD 01D3'              CALL    TOP     ;HAVE WE TESTED THE TOP WORD?
00FA'  CA 0129'              JZ      CMPIT   ;IF SO, LETS MOVE ON.
00FD'  E5                    PUSH    H
00FE'  60                    MOV     H,B
00FF'  69                    MOV     L,C
0100'  3A 0401'              LDA     REF
0103'  77                    MOV     M,A     ;RESTORE TEST WORD TO BCKGND.
0104'  E1              INSPEC: POP     H       ;BACKGROUND STILL CLEAN?
0105'  E5                    PUSH    H
0106'  C5                    PUSH    B
0107'  CD 019C'              CALL    CHKIT
010A'  C1                    POP     B
010B'  21 0402'              LXI     H,FLAG  ;PRINT EVERY 1/32 TICK.
010E'  35                    DCR     M       ;COUNT DOWN.
010F'  C2 0124'              JNZ     ..NTK
0112'  21 0403'              LXI     H,TEMPO
0115'  3A 0401'              LDA     REF
0118'  CD 026F'              CALL    PTBYT   ;PRINT BCKGND 1/2 BYTE.
011B'  34                    INR     M
011C'  FC 023A'              CM      LINE
011F'  21 0402'              LXI     H,FLAG  ;RESTORE COUNTER
0122'  3620                  MVI     M,32    ;FOR THE NEXT ROUND.
0124'  E1              ..NTK: POP     H
0125'  03                    INX     B       ;MOVE WRITE POINTER UP ONE
0126'  C3 00C3'              JMP     TEST    ;GO BACK FOR THE NEXT ROUND.
0129'  3A 0401'        CMPIT: LDA     REF     ;GET BACKGROUND,
012C'  2F                    CMA             ;COMPLEMENT IT,
012D'  32 0401'              STA     REF     ;AND PUT IT BACK.
0130'  FE55                  CPI     55H
0132'  C2 00B2'              JNZ     STRTST  ;COMPLEMENT TEST THIS CHIP.
0135'  2A 040C'              LHLD    BGN
0138'  CD 0166'              CALL    SETUP   ;SET UP LIMITS FOR NEXT CHIP.
013B'  E5                    PUSH    H
013C'  D5                    PUSH    D
013D'  EB                    XCHG
013E'  2A 0406'              LHLD    END     ;BRING IN THE UPPER LIMIT
0141'  EB                    XCHG
0142'  CD 01CD'              CALL    HILO    ;IS THE TOP OF THE LAST CHIP?
0145'  D1                    POP     D
0146'  E1                    POP     H
0147'  DA 014D'              JC      ..END   ;IF SO, THAT'S ALL FOLKS.
014A'  C3 008A'              JMP     SOFT    ;IF NOT, GO BACK FOR ANOTHER.
014D'  21 0374'        ..END: LXI     H,MSGE
0150'  CD 0259'              CALL    TYPE
0153'  C3 E800               JMP     BOOT    ;END OF TEST SO REBOOT.
                       ;
                       ;       <<< SUBROUTINES >>>
                       ;
0156'  E5              CHKOMP: PUSH    H
0157'  C5                    PUSH    B
0158'  60                    MOV     H,B
0159'  69                    MOV     L,C
```

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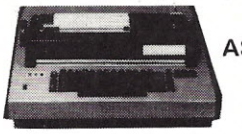
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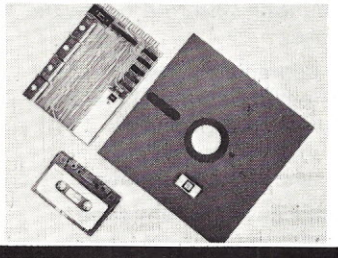
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```
015A' 3A 0401'          LDA     REF     ;GET THE REFERENCE BYTE,
015D' 2F                CMA             ;COMPLEMENT IT; AND THEN,
015E' 46                MOV     B,M     ;GET THE BYTE FROM MEMORY
015F' B8                CMP     B       ;ARE THEY THE SAME?
0160' C4 01D9'          CNZ     ERROR   ;IF NOT, LET'S TELL ABOUT IT.
0163' C1                POP     B
0164' E1                POP     H
0165' C9                RET
                        ;
0166' E5        SETUP:  PUSH    H       ;THE OLD SHELL GAME.
0167' EB                XCHG
0168' 2A 0408'          LHLD    INC     ;GET CHIP SIZE.
016B' EB                XCHG
016C' 19                DAD     D       ;ADD IT TO LOWER LIMIT.
016D' EB                XCHG            ;WE HAVE A NEW UPPER LIMIT
016E' E1                POP     H       ;IN THE DE REG. PAIR.
016F' C9                RET
                        ;
0170' CD 029D'  GETHEX: CALL    KBD     ;GET THE CHARACTER.
0173' 4F                MOV     C,A
0174' CD 0181'          CALL    NIBBLE
0177' D8                RC              ;DID WE BLOW IT?
0178' 29                DAD     H       ;SHIFT 'EM LEFT 4 BITS.
0179' 29                DAD     H
017A' 29                DAD     H
017B' 29                DAD     H
017C' B5                ORA     L       ;PUT THE TWO NIBBLES TOGETHER
017D' 6F                MOV     L,A     ;PUT THEM IN L.
017E' C3 0170'          JMP     GETHEX
0181' D630      NIBBLE: SUI     30H     ;ASCII BYTE TO HEX NIBBLE.
0183' D8                RC              ;GO BACK IF ITS LESS THAN A 0
0184' FE17              CPI     17H     ;IS IT BIGGER THAN AN F?
0186' 3F                CMC
0187' D8                RC              ;IF SO, GO BACK.
0188' FE0A              CPI     10      ;IS IT LESS THAN A?
018A' 3F                CMC
018B' D0                RNC             ;IF SO, GO BACK.
018C' D607              SUI     07      ;10-15 BECOME A-F.
018E' FE0A              CPI     10
0190' C9                RET
                        ;
0191' 3A 0401'  FILLIT: LDA     REF     ;FILL MEMORY WITH BACKGROUND.
0194' 77                MOV     M,A
0195' CD 01CD'          CALL    HILO    ;INC HL. ARE WE OVER THE TOP?
0198' D2 0191'          JNC     FILLIT
019B' C9                RET
                        ;
019C' 3A 0401'  CHKIT:  LDA     REF     ;GET THE REFERENCE BYTE.
019F' 46                MOV     B,M     ;GET THE BYTE FROM MEMORY.
01A0' B8                CMP     B       ;ARE THEY THE SAME?
01A1' C4 01D9'          CNZ     ERROR   ;IF NOT, TELL ABOUT IT.
01A4' CD 01CD'          CALL    HILO
01A7' D2 019C'          JNC     CHKIT   ;GO BACK FOR THE NEXT ONE
01AA' C9                RET
                        ;
01AB' 79        SAME:   MOV     A,C     ;IS BC=HL?
01AC' AD                XRA     L
01AD' C0                RNZ             ;GO BACK IF L<>C.
01AE' 78                MOV     A,B
01AF' AC                XRA     H
01B0' C9                RET
                        ;
01B1' 21 040A'  DELAY:  LXI     H,DEL   ;GET THE # OF DELAY PERIODS.
01B4' 4E                MOV     C,M
01B5' 23                INX     H
01B6' 46                MOV     B,M
01B7' CD 02B2'  ..LOOP: CALL    STOP
01BA' 78                MOV     A,B
01BB' B1                ORA     C
01BC' C8                RZ              ;RETURN AT END OF THE DELAY.
01BD' 261B              MVI     H,1BH   ;ONE DELAY PERIOD
01BF' 2E09      ..INLP: MVI     L,9
01C1' 2D                DCR     L
01C2' C2 01C1'          JNZ     .-1
01C5' 25                DCR     H
01C6' C2 01BF'          JNZ     ..INLP
01C9' 0B                DCX     B       ;GO BACK FOR THE NEXT PERIOD.
01CA' C3 01B7'          JMP     ..LOOP
                        ;
01CD' 23        HILO:   INX     H       ;ADVANCE HL.  HL>DE?
01CE' 7B                MOV     A,E
01CF' 95                SUB     L
01D0' 7A                MOV     A,D
01D1' 9C                SBB     H
01D2' C9                RET
                        ;
01D3' 7B        TOP:    MOV     A,E     ;IS DE=BC?
01D4' A9                XRA     C
01D5' C0                RNZ             ;GO BACK IF E<>C.
01D6' 7A                MOV     A,D
01D7' A8                XRA     B
01D8' C9                RET
                        ;
01D9' F5        ERROR:  PUSH    PSW     ;SAVE THE TEST BYTE.
01DA' E5                PUSH    H
01DB' 21 0400'          LXI     H,ERCNT ;LOOK AT ERROR COUNTER.
```

More

core memory, is the checkerboard and reverse checkerboard test, designed to find row-to-row and column-to-column leakage and refresh problems. This test will work just fine with RAMs in which the number of columns is equal to the number of bits in the computer's word, but when the bits from the computer's memory are mapped into a memory chip in which the number of columns does not equal the number of bits per word, the pattern becomes the bar column test, or a variation of the bar column test (see Fig. 1).

For example, the pattern written in the checkerboard test is 55H, AAH, 55H, AAH, . . . , in an eight-bit machine. If this is mapped into one-bit-wide RAMs, it becomes 55H, 55H, . . . , or AAH, AAH, . . . , depending on which RAM has which bit of the word. In a two-bit-wide chip, it becomes 99H, 99H, ... In a four-bit-wide chip, it becomes A5H, A5H, A5H, ...

Hippity-Hop Memory Test

A test that will permit the testing of all the memory bits and the interaction between the bits, as well as addressing and refresh problems, is the Hippity-Hop memory test. The first step of the test is to fill the memory with a background of 55 hex. After a delay to allow for leakage, the background is checked for any bad bits. The complement of the background is then written into the first location.

Another delay is implemented to allow for leakage, and then the first word is checked. Then the second word (background) is checked. The first word is checked again, and then the third word (background) is checked. This process continues until the last background word is checked. At this point, the background pattern is written into the first word, and then the background is checked for errors.

Now, the complement of the background is written to the second word. There is a delay, and the second word is then checked. The first word is read to make sure that it still has the background pattern in it, and then the second word is read to make sure that the complement of the background is still in it. The third word (background) is checked, and then the second word (complement of the background) is checked.

This continues as above until the last word is checked. This process is continued until the highest word con-

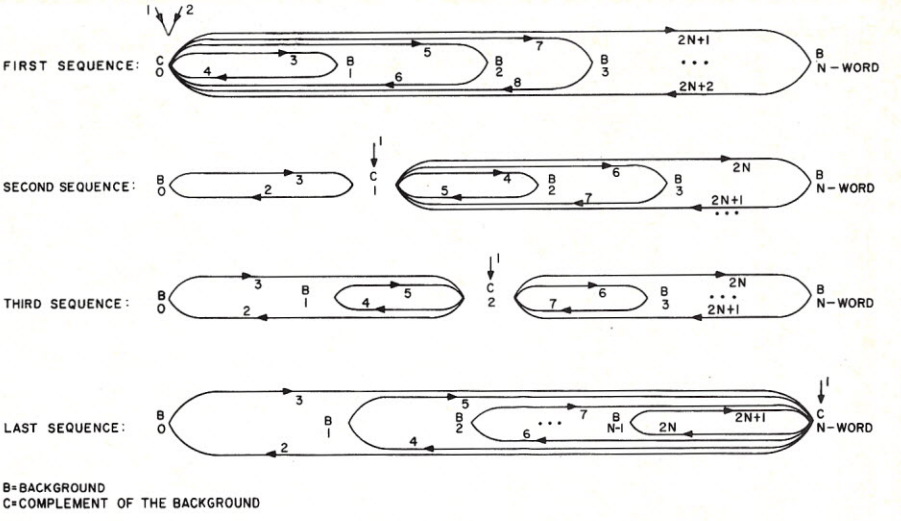


Fig. 2. Read and check sequence of the Hippity-Hop memory test.

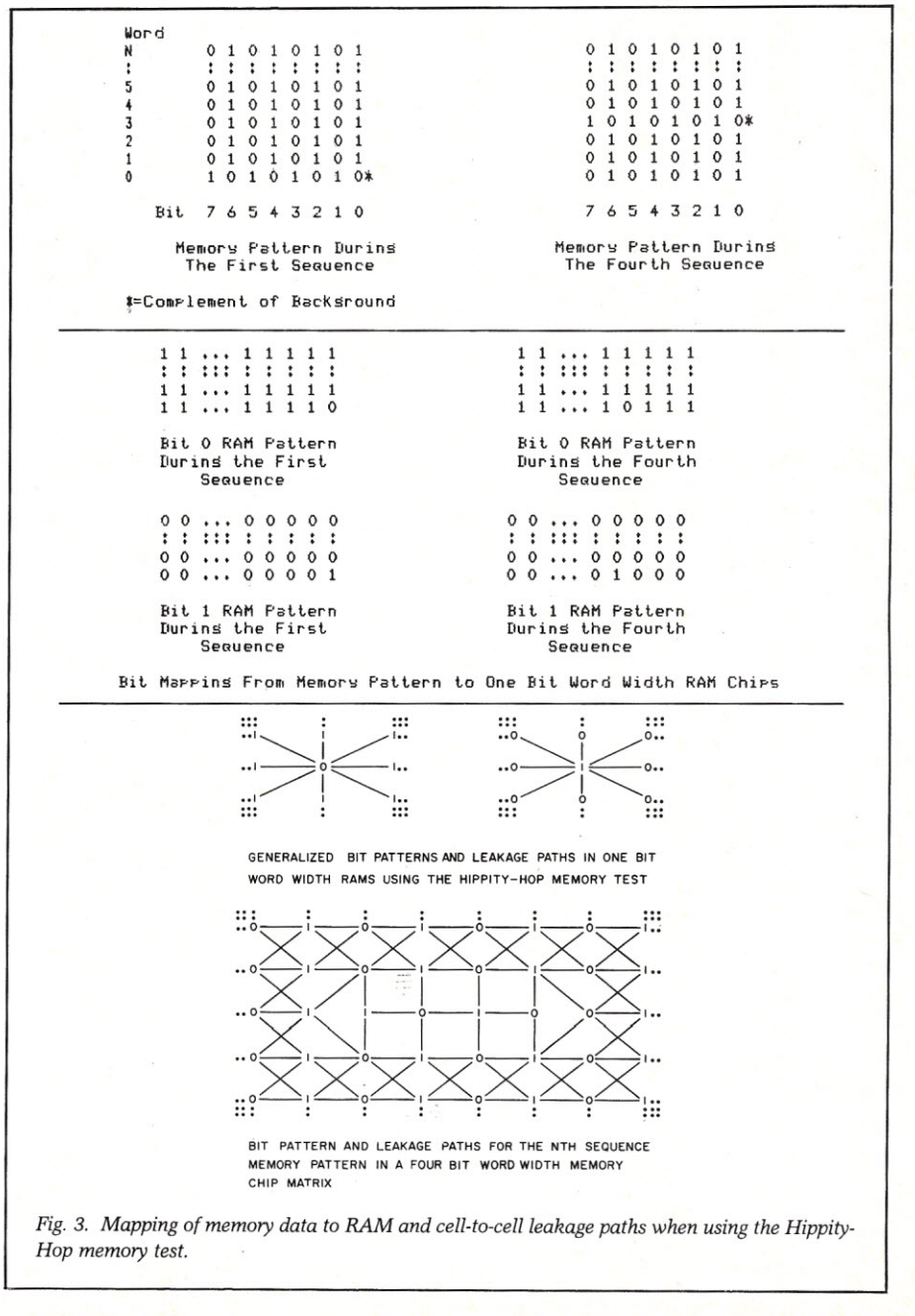


Fig. 3. Mapping of memory data to RAM and cell-to-cell leakage paths when using the Hippity-Hop memory test.

Listing continued.

```
01DE'   35              DCR     M       ;ONLY 100 ERRORS PLEASE.
01DF'   7E              MOV     A,M
01E0'   FE00            CPI     0
01E2'   CA E800         JZ      BOOT    ;HOLD THAT TIGER!
01E5'   E1              POP     H
01E6'   3A 0404'        LDA     SENT    ;SEND ERROR HEADING?
01E9'   B7              ORA     A
01EA'   C2 01F9'        JNZ     ..NO    ;IT ALREADY HAS BEEN SENT.
01ED'   2F              CMA
01EE'   32 0404'        STA     SENT    ;SEND IT ONLY ONCE.
01F1'   E5              PUSH    H
01F2'   21 0386'        LXI     H,MSG
01F5'   CD 0259'        CALL    TYPE    ;SEND THE HEADING.
01F8'   E1              POP     H
01F9'   7C      ..NO:   MOV     A,H     ;SEND THE HIGH BYTE OF THE
01FA'   CD 0266'        CALL    WRIT2
01FD'   7D              MOV     A,L     ;ADD., AND THEN THE LOW BYTE.
01FE'   CD 0266'        CALL    WRIT2
0201'   CD 0232'        CALL    BLK     ;SPACE OVER,
0204'   F1              POP     PSW     ;GET TEST BYTE,
0205'   F5              PUSH    PSW     ;SAVE AGAIN, AND
0206'   CD 0266'        CALL    WRIT2   ;PRINT IT.
0209'   CD 0232'        CALL    BLK
020C'   F1              POP     PSW     ;GET THE BYTE BACK.
020D'   A8              XRA     B       ;GET BAD BIT LOC.
020E'   0608            MVI     B,8     ;NUMBER OF BITS/BYTE.
0210'   17      ..BIT:  RAL             ;SET/RESET CARRY.
0211'   F5              PUSH    PSW     ;SAVE THE BAD BITS.
0212'   3E18            MVI     A,18H
0214'   8F              ADC     A       ;MAKE '0' OR '1'
0215'   C611            ADI     11H
0217'   FE42            CPI     42H     ;IS IT A 'B' FOR BAD?
0219'   CA 021E'        JZ      ..SEN   ;IF IT IS LETS PUT IT OUT.
021C'   C606            ADI     6       ;ELSE, MAKE A 'G' FOR GOOD.
021E'   F5      ..SEN:  PUSH    PSW
021F'   CD 0232'        CALL    BLK
0222'   F1              POP     PSW
0223'   CD 0277'        CALL    SEND
0226'   F1              POP     PSW     ;GET BAD BYTE.
0227'   05              DCR     B
0228'   C2 0210'        JNZ     ..BIT   ;THERE MUST BE MORE.
022B'   CD 023C'        CALL    CRLF
022E'   77              MOV     M,A
022F'   C3 02B2'        JMP     STOP
                        ;
0232'   3E20   BLK:     MVI     A,' '   ;SEND A BLANK.
0234'   CD 0277'        CALL    SEND
0237'   C3 0277'        JMP     SEND
023A'   3640   LINE:    MVI     M,40H   ;RESET TEST COUNTER.
023C'   3E0D   CRLF:    MVI     A,CR    ;CRLF ON CONSOLE.
023E'   CD 0277'        CALL    SEND
0241'   3E0A            MVI     A,LF
0243'   C3 0277'        JMP     SEND
                        ;
0246'   FE2C   CHK:     CPI     ','     ;A COMMA BETWEEN ADDRESSES?
0248'   C8              RZ
0249'   FE20            CPI     ' '     ;OR IS IT A SPACE?
024B'   C8              RZ
024C'   FE0D            CPI     CR      ;INPUT FINISHED?
024E'   C2 002A'        JNZ     START   ;MUST HAVE BLOWN IT=>RESTART
0251'   78              MOV     A,B
0252'   3D              DCR     A
0253'   C2 002A'        JNZ     START   ;TOO MANY OR TOO FEW PARAMS.
0256'   C3 023C'        JMP     CRLF
                        ;
0259'   CD 02B2'  TYPE:  CALL    STOP    ;TEST FOR AN ABORT.
025C'   7E              MOV     A,M     ;MESSAGE SENDER ROUTINE.
025D'   B7              ORA     A
025E'   C8              RZ              ;LOOK FOR END OF MESSAGE.
025F'   CD 0277'        CALL    SEND
0262'   23              INX     H
0263'   C3 0259'        JMP     TYPE
                        ;
0266'   F5   WRIT2:    PUSH    PSW     ;BINARY TO ASCII HEX
0267'   0F              RRC
0268'   0F              RRC
0269'   0F              RRC
026A'   0F              RRC
026B'   CD 026F'        CALL    PTBYT
026E'   F1              POP     PSW
026F'   E60F   PTBYT:   ANI     0FH
0271'   C690            ADI     90H
0273'   27              DAA
0274'   CE40            ACI     40H
0276'   27              DAA
                ;
                ;       <<< I/O ROUTINES >>>
                ;
0277'   F5   SEND:    PUSH    PSW     ;CONSOLE OUTPUT ROUTINE
0278'   DB03 ..S:     IN      CONSP
027A'   E601            ANI     CTBNE   ;BUFFER EMPTY?
027C'   CA 0278'        JZ      ..S     ;IF NOT, GO BACK.
027F'   F1              POP     PSW
0280'   D302            OUT     CONDP   ;PUT OUT THE CHARACTER.
0282'   E5              PUSH    H
0283'   F5              PUSH    PSW

0284'   21 0405'        LXI     H,PRNT
```

More

tains the complement of the background, and all the background has been tested. (See Fig. 2.) After the above sequence is completed, the background is complemented and the process is started all over again. If an error is encountered, the bad address and the bad bit information will be displayed on the console, and if one is available, typed on the printer.

The manner in which the memory pattern maps into RAMs for leakage tests is shown in Fig. 3. The pattern for the four-bit-wide RAM can be generalized for any RAM with a width greater than one bit.

The test has been written in 8080 code so that it can be run on an 8080, 8085 or Z-80. The test was written to be run on a North Star Horizon. The code is ROMable as long as there is a little RAM on top for temporary storage and the stack. The test has its own I/O drivers so that the test can be run in the areas that are normally occupied by DOS and BIOS. The I/O routines are clearly marked, so that they can be changed as necessary.

The test is divided into segments. For example, say you are testing a 16K board that consists of 4K chips, and it occupies the addresses from 0 to 3FFFH. The range of the test is entered as 0,3FFF, and the chip depth is FFF (4K). The test will first test the area from 0 to FFFH, then it will test 1000H to 1FFFH, then 2000H to 2FFFH and finally 3000H to 3FFFH.

In Table 1, you will see that the time of the test (with zero delay) is proportional to the square of the size of the chip. So, be sure to check the memory in the smallest possible segments (chip depth); otherwise, the test will take longer than is necessary. It should be emphasized that this is a very slow test (see Table 1). There are not too many users who would be willing to spend ten days checking a group of 64K RAMs using a 1000 ms delay.

When running the program, you will be asked if you have a printer. You should respond with Y for yes or N for no. When the limits of the test are requested, the chip address boundaries are the only boundaries that can be given for the test, and this information must be given in hexadecimal. You may check as many chips as you like in a sequence. You will then be asked for the delay period. One delay period is about one ms. The minimum delay is 0, and the maximum delay is FFFFH (64K) ms. The depth of the chip (also given in

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hexadecimal) is a very important piece of information for the test. If either the address or chip depth information is incorrect, the test will not function properly.

An example of the printer, or console, output is shown in the sample run. The test was set up to test the 16K block of memory from 4000H to 7FFFH. The depth of the chip was FFFH (4096 words), and a delay of 1FH (31) ms was specified. The test ran just fine for the first two 4K blocks of memory. Note that the test prints out the background pattern while it is running. This is to reassure the user by letting her/him know that the test is progressing. As soon as the program started to test the third 4K block, errors started to occur. When errors are encountered, the bell on the console rings and the error information is printed. In this case, the chip for bit number two was bad.

This is an example of the output for a hard error. In the case of pattern sensitivity errors or most speed problems, the addresses of the bad memory locations would not occupy sequential addresses for an entire block. Rather, they would appear to be random and nonrepeating.■

References

Breuer, Melvin A., and Arthur D. Friedman, *Diagnosis and Reliable Design of Digital Systems*. Potomac, MD: Computer Science Press.

Chip Depth		Delay Time in Milliseconds 0	10 (0AH)	100 (64H)	1000 (3E8H)	10000 (2710H)
512	(1FFH)	0:00:12	0:00:58	0:02:31	0:17:54	2:51:48
1024	(3FFH)	0:03:13	0:03:34	0:06:38	0:37:23	5:44:53
2048	(7FFH)	0:12:54	0:13:35	0:19:44	1:21:12	11:35:54
4096	(FFFH)	0:51:39	0:53:01	1:05:19	3:08:13	23:37:19
8192	(1FFFH)	3:26:39	3:29:23	3:53:58	7:59:45	48:57:39
16384	(3FFFH)	13:46:38	13:52:02	14:41:15	22:52:48	104:48:18
32768	(7FFFH)	55:06:35	55:17:30	56:55:49	73:18:53	237:09:35
65536	(FFFFH)	220:26:20	220:48:11	224:04:48	256:50:54	584:32:00

Table 1. Approximate run time (hours:minutes:seconds) of the Hippity-Hop memory test for a single chip (chip depth vs delay time). (Run on a 4 MHz Z-80 with no wait states.)

```
Range -- 4000,7FFF

In HEX, how many delay periods?  1F

In HEX, how deep are your memory chips?  FFF


Testing 4000 to 4FFF
55555555555555555555555555555555555555555555555555555555555555555555
55555555555555555555555555555555555555555555555555555555555555555555
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA


Testing 5000 to 5FFF
55555555555555555555555555555555555555555555555555555555555555555555
55555555555555555555555555555555555555555555555555555555555555555555
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA


Testing 6000 to 6FFF

      ** ERRORS ENCOUNTERED **
    B => BAD BIT    G => GOOD BIT
ADDR TEST   7  6  5  4  3  2  1  0 - BITS
6000  55    G  G  G  G  G  B  G  G
6001  55    G  G  G  G  G  B  G  G
6002  55    G  G  G  G  G  B  G  G
6003  55    G  G  G  G  G  B  G  G
6004  55    G  G  G  G  G  B  G  G
6005  55    G  G  G  G  G  B  G  G
6006  55    G  G  G  G  G  B  G  G
6007  55    G  G  G  G  G  B  G  G
6008  55    G  G  G  G  G  B  G  G
6009  55    G  G  G  G  G  B  G  G
600A  55    G  G  G  G  G  B  G  G
600B  55    G  G  G  G  G  B  G  G
```

Sample printer output.

Listing continued.

```
0287'   7E                      MOV     A,M
0288'   FEFF                    CPI     OFFH    ;IS THERE A PRINTER?
028A'   C2 029A'                JNZ     ..S1    ;IF NOT SKIP THE ROUTINE
028D'   DB05            ..P:    IN      PRNSP   ;PRINTER OUTPUT ROUTINE
028F'   E601                    ANI     PTBNE   ;BUFFER EMPTY?
0291'   CA 028D'                JZ      ..P
0294'   F1                      POP     PSW
0295'   D304                    OUT     PRNDP   ;PRINT THE CHARACTER.
0297'   C3 029B'                JMP     ..S2
029A'   F1              ..S1:   POP     PSW
029B'   E1              ..S2:   POP     H
029C'   C9                      RET
                                ;
029D'   DB03            KBD:    IN      CONSP   ;CONSOLE INPUT ROUTINE
029F'   E602                    ANI     CIBE    ;IS THERE A CHARACTER?
02A1'   CA 029D'                JZ      KBD     ;IF NOT GO BACK.
02A4'   DB02                    IN      CONDP   ;GET THE CHARACTER.
02A6'   E67F                    ANI     7FH     ;CLEAR THE PARITY BIT.
02A8'   FE60                    CPI     60H     ;MAKE SURE IT IS UPPER CASE,
02AA'   DA 0277'                JC      SEND    ;AND ECHO THE INPUT.
02AD'   D620                    SUI     20H     ;ELSE, MAKE IT UPPER CASE,
02AF'   C3 0277'                JMP     SEND    ;AND THEN ECHO THE INPUT.
                                ;
02B2'   DB03            STOP:   IN      CONSP   ;WANT TO STOP?
02B4'   E602                    ANI     CIBE
02B6'   C8                      RZ
02B7'   DB02                    IN      CONDP
02B9'   E67F                    ANI     7FH     ;STRIP PARITY.
02BB'   FE03                    CPI     3       ;IS IT CONTROL-C?
02BD'   C0                      RNZ             ;MUST BE SOMETHING ELSE.
02BE'   C3 E800                 JMP     BOOT    ;BOOT UP DISK
                        ;
                        ;       <<< MESSAGES >>>
                        ;
02C1'   3C3C20486970    MSG1:   .ASCIZ '<< Hippity-Hop Memory Test Version 1.1
                         >>
02EA'   0D0A446F2079    Do you have a printer?   '
0306'                   MSG2:   .ASCIZ '
0306'   0D0A52616E67    Range -- '
0312'                   MSG3:   .ASCIZ '
0312'   0D0A496E2048    In HEX, how many delay periods?  '
0336'                   MSG4:   .ASCIZ '
0336'   0D0A496E2048    In HEX, how deep are your memory chips?  '
0362'                   MSG5:   .ASCIZ '
0362'   0D0A
0364'   0D0A54657374    Testing '
036F'   20746F2000      MSG6:   .ASCIZ ' to '
0374'                   MSGE:   .ASCIZ  '
0374'   0D0A54455354    TEST COMPLETE
0383'   0D0A00          '
0386'   07              MSG:    .BYTE   7       ;RING DEM BELLS
                                .ASCIZ  '
0387'   0D0A20202020           ** ERRORS ENCOUNTERED **
03A8'   0D0A20202020        B => BAD BIT   G => GOOD BIT
03CB'   0D0A41444452    ADDR TEST   7  6  5  4  3  2  1  0 - BITS
03F6'   0D0A00          '
                        ;
                        ;  <<< INITIALIZED TEMPORARY STORAGE AND STACK >>>
                        ;
0400'                   .LOC    RAM
                        ;
0400'   65              ERCNT:  .BYTE   101     ;PRINT ONLY 100 ERRORS
0401'   55              REF:    .BYTE   55H     ;BACKGROUND PATTERN
0402'   01              FLAG:   .BYTE   1
0403'   40              TEMPO:  .BYTE   64      ;LINE LENGTH COUNTER
0404'   00              SENT:   .BYTE   0       ;ERROR HEADING FLAG
0405'   00              PRNT:   .BYTE   0
0406'   0000            END:    .WORD   00
0408'   0000            INC:    .WORD   00
040A'   0000            DEL:    .WORD   00
040C'   0000            BGN:    .WORD   00
0422'                   STACK=  .+20
                        ;
                        .END
```

+++++ Symbol Table +++++

```
BCKGND 00B4'    BGN    040C'    BLK    0232'    BOOT   E800
CHK    0246'    CHKIT  019C'    CHKOMP 0156'    CIBE   0002
CMPIT  0129'    CONDP  0002     CONSP  0003     CR     000D
CRLF   023C'    CTBNE  0001     DEL    040A'    DELAY  01B1'
END    0406'    ERCNT  0400'    ERROR  01D9'    FILLIT 0191'
FLAG   0402'    GETADD 0033'    GETDEL 0044'    GETDEP 005D'
GETHEX 0170'    HILO   01CD'    HRWEGO 0014'    INC    0408'
INIT   0000'    INSPEC 0104'    KBD    029D'    LF     000A
LINE   023A'    MSG    0386'    MSG1   02C1'    MSG2   0306'
MSG3   0312'    MSG4   0336'    MSG5   0362'    MSG6   036F'
MSGE   0374'    NIBBLE 0181'    PRNDP  0004     PRNSP  0005
PRNT   0405'    PTBNE  0001     PTBYT  026F'    RAM    0400'
REF    0401'    SAME   01AB'    SEND   0277'    SENT   0404'
SETUP  0166'    SOFT   008A'    STACK  0422'    START  002A'
STOP   02B2'    STRTST 00B2'    TEMPO  0403'    TEST   00C3'
TOP    01D3'    TYPE   0259'    WRIT2  0266'    .BLNK. 0000:03 X
.DATA. 0000"  X .PROG. 040E'  X
```


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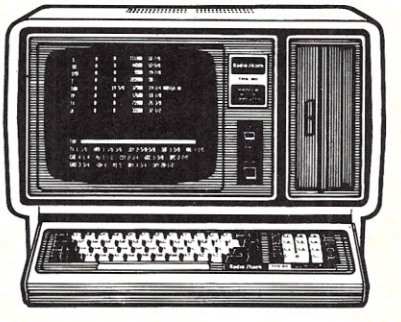
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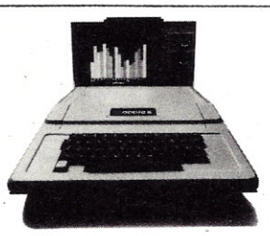
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Here's a palatable method to attach a parallel printer to your PET.

A PIE Taster's Report

By Garold R. Stone

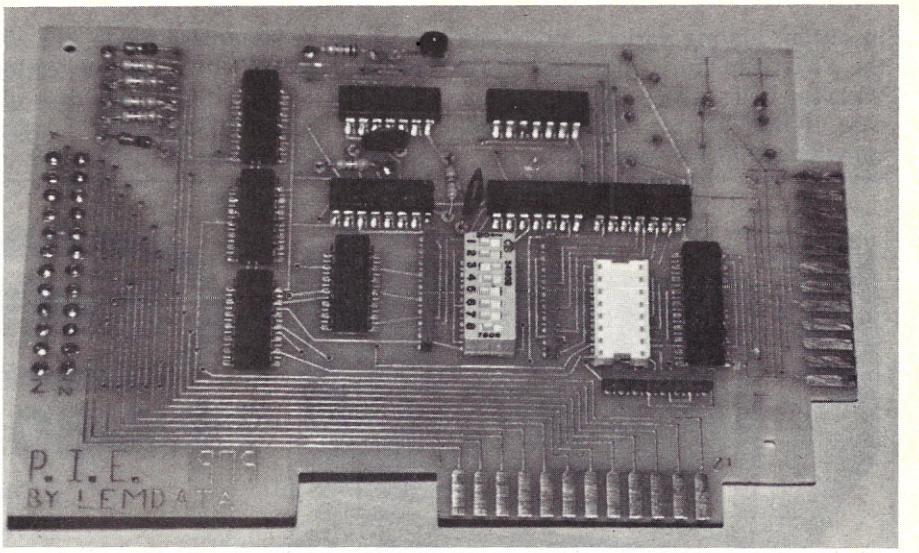
For the past year I've had a Southwest Technical Products model PR-40 printer connected to my PET via the parallel user port. I've been using various software subroutines to send output to the printer by poking to the user port and its associated registers.

But to use the LIST command or the other PET BASIC commands—like PRINT#, which outputs to the PET's IEEE port—I needed an interface that would let me connect my printer to the IEEE port. So I bought the PIE (parallel interfacing element) by Lemdata.

The PIE comes completely assembled on a single, 4 by 6 inch printed circuit board for $89.95. It plugs vertically into the IEEE port, flat against the back of the PET, taking up very little room and out of harm's way.

The cable from the printer attaches to the PIE's card edge C-S. This is the same as the PET's parallel user port card edge, where my printer used to live. A cable clamp with a self-adhesive backing sticks to the PET and protects the PIE from accidental tugs on the printer cable. The PIE circuit board extends the IEEE bus to another card edge, C-E, so additional IEEE devices can still be attached.

The IEEE bus allows many pieces of equipment to be attached simultaneously to the PET. Each device is selected for communication by means of its particular IEEE device number. The PIE directs output to card edge C-S whenever data on the IEEE bus is addressed to the PIE's device number. You can set the device number from 4 to 30 with a DIP switch on the PIE. I set mine to device 4 because that is the number used in most software for the PET printer.



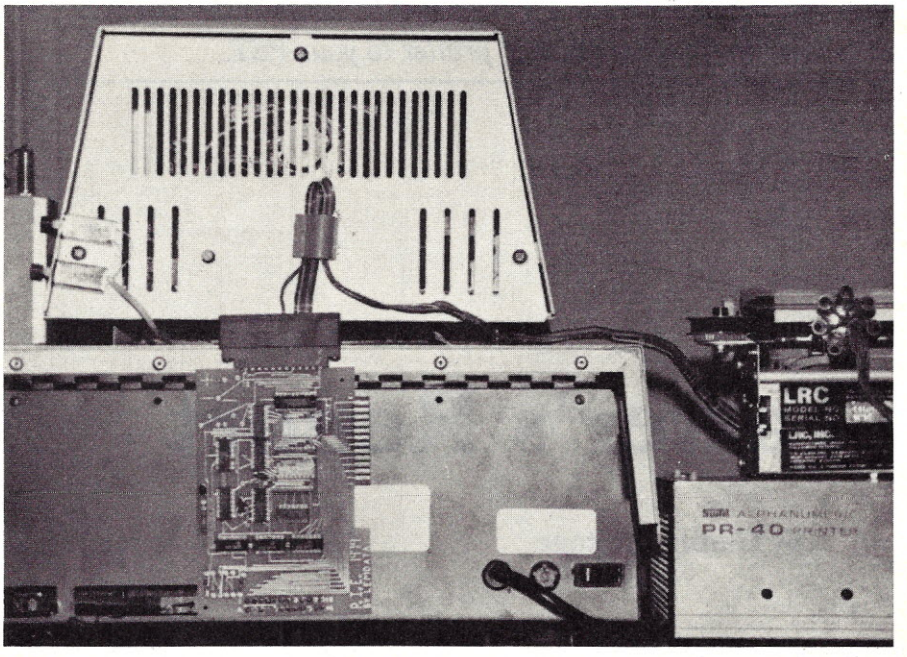
PIE circuit board.

The PIE comes already wired for strobe and acknowledge handshaking signals for a printer using negative logic (normally, +5 V goes to 0 V and returns to +5 V). Negative logic is used by almost all parallel printers.

Handshaking for positive logic (normally, 0 V goes to +5 V and returns to 0 V) is available, but you must cut two traces on the circuit board and solder two jumper wires. Although very few users will have to perform this simple surgery, it would have been nice if this option were switch selectable. In any case, be sure to know your printer's requirements to ensure proper operation. The PIE gives complete pin-for-pin details for wiring a cable from the printer. Lemdata also sells ready-wired printer cables.

If your printer has lowercase, you will want to consider getting the Code Converter ROM, which plugs into an empty socket on the PIE. This optional ROM corrects for variations

Address correspondence to Garold R. Stone, PO Box 153, Annapolis Junction, MD 20701.



Back of my system, showing PIE, PR-40 printer, CB-2 sound amp and Uncrasher.

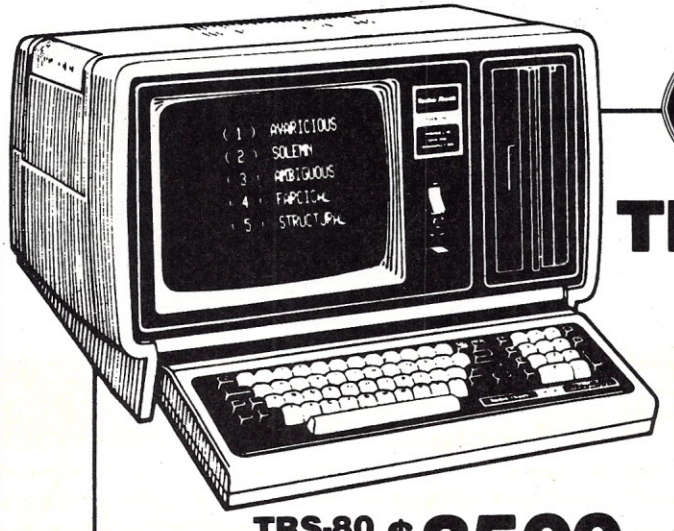
in output among various models in the PET/CBM line. Converter ROM V1 is for PETs which shift for lowercase. ROM V2 is for PET/CBM models which shift for uppercase.

When in lowercase mode, the V1 ROM converts PET output codes 193–218 to the ASCII lowercase alphabet values 97–122. PET codes 97–122 are converted to 193–218 so that all values from 0–255 may be output. Similarly, the V2 ROM converts PET codes 65–90 to 97–122, 97–122 to 193–218 and 193–218 to 65–90.

To use the converter ROM you must manually set a DIP switch on the PIE to either graphics or lowercase to match the mode the PET is in at any given time. My PR-40 printer converts lowercase input to uppercase before printing, so I get by without needing a converter ROM for my PIE.

The PIE instruction manual shows how to connect a +5 V power supply. It also gives ways to get power from some popular printers. I chose to tap my PR-40 printer right at the voltage regulator, IC17 (Fig. 1). The 7508 regulator's +5 V output is the lead which faces the center of the PR-40's main circuit board.

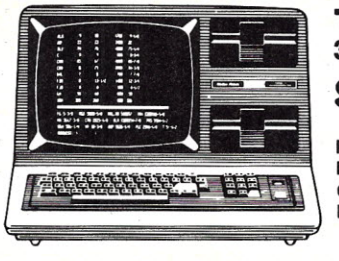
I grounded the regulator's output lead with a test clip during soldering as a heat and static guard. The PIE manual suggested using the +5 V side of capacitor C12, which is probably a safer soldering point, but that involves removing the circuit board from the PR-40. I let pin 1 of PR-40



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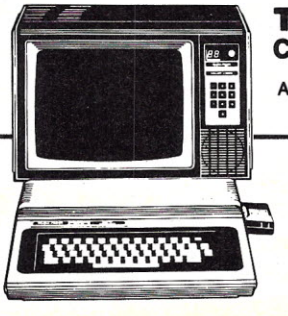
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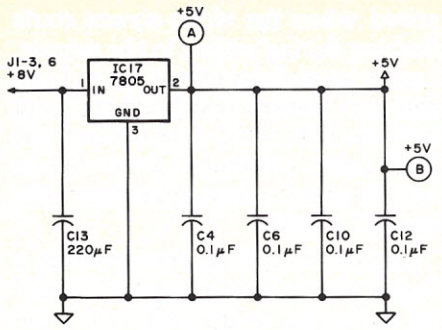


Fig. 1. Power regulation stage of PR-40 printer showing two points to tap +5 V for the PIE.

connector J-4 serve as both data and power ground.

Connecting Power

There are two ways to connect power to the PIE itself. One is to connect directly to the PIE circuit board with two power leads provided. Or, as the manual suggests, you can supply the +5 V through pin 5 of the printer connector to pin 5 of C-S on the PIE. The ground is wired through printer connector pin 1, 12, A or N (Table 1). This allows the power and data to be in a single, detachable printer cable.

Signal	PR-40	Cable	PIE C-S	PET User Port
Ground	J4-1	A	A	A Ground
Data Accepted	J4-2	B	B Data Accepted	B CA1—Data Accepted
D0	J4-10	C	C	C PA0
D1	J4-11	D	D	D PA1
D2	J4-12	E	E	E PA2
D3	J4-8	F	F	F PA3
D4	J4-9	H	H	H PA4
D5	J4-5	J	J	J PA5
D6	J4-6	K	K	K PA6
D7	not used	L	L	L PA7
Data Ready	J4-3	M	M	M CB2—Data Ready
Ground	J4-4,J4-1	N,1,12	N,1,12	N Ground
optional: +5 volts	Fig. 1	5	5	5 Diagnostic Sense

Table 1. Cable wiring and pin definitions. Note: The PET user port must be preprogrammed before it can be used with a parallel printer. See references.

If you wire the power source directly to the PIE circuit board, then you are free to plug the printer connector into either the PET user port or the PIE, since both are identical as far as data is concerned. But if you choose to power pin 5 of the printer connector, as I did, you must take some precautions before you plug your printer into the user port.

If you have +5 V on pin 5 of the printer connector, then plugging it into the user port puts +5 V from the PIE's power source to pin 5 of the PET user port. That in itself is no problem, because pin 5 on the user port is already +5 V. The problem is that some accessories for the PET

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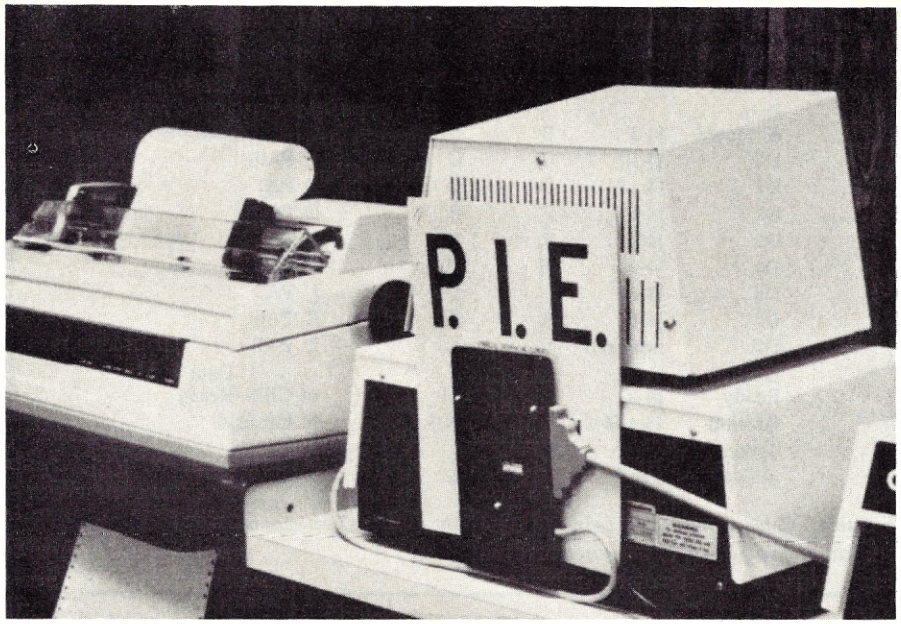
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Lemdata also offers the PIE-C, which sells for $119.95. Note directly wired printer cable at bottom right of PIE-C and the modem cable at IEEE extension.

might make use of user port pin 5, called the diagnostic sense pin, and a potentially dangerous conflict might result.

The particular accessory I have installed is the Uncrasher (available from International Technical Systems, Box 264, Woodbridge, VA 22194), which is a warm start reset switch for the PET. It lets my BASIC 3.0 ROM PET recover from a system crash without losing the information I had in memory.

It works by grounding the diagnostic sense pin (user port pin 5). So, if pin 5 of the printer connector is used for power, then using the Uncrasher when the printer is plugged into the PET user port would result in a dead short of the PIE's power source.

My way around this conflict was to put a switch in the +5 V power line, which disconnects power from the connector before I plug the printer back into the user port, where I used to have it. I recommend such a switch even if you do not already have accessories which might ground the diagnostic sense pin. This prevents any fault in the power source from affecting the PET. Of course, such precautions are not necessary if you leave the printer connected to the PIE.

IEEE Commands

The PIE manual has instructions and good examples showing how to use the PET's IEEE BASIC commands. But I would like to clarify a commonly held misconception about the CLR command, which causes problems with any printer or other IEEE device.

Both the PIE manual and the PET user manual show how to use the CMD command. For example:

```
OPEN 1,4
CMD 1
LIST
```

assigns file 1 to device 4, and makes device 4 (the printer) "...the primary output device for BASIC. PRINT or LIST commands are now directed to this primary device, rather than to the video screen.... the CMD of the printer device, followed by LIST, results in hard copy, instead of a video screen listing... since neither the CMD nor LIST [nor PRINT] command terminates [IEEE] bus operation for the device, *a PRINT# is required to terminate a CMD command.*" (My emphasis. See Reference 7.)

PRINT#1 returns the PET to screen operation. The misconception lies in trying to use the CLR command to terminate a CMD command. Using CLR incorrectly this way will seem to return PRINT and LIST to video screen operation, but it leaves the operating system in an undefined state, i.e., flaky. The cursor doesn't work right, and the system is liable to crash. This also means that when you want to use CLR for its defined purpose, you should first properly terminate any current CMD with a PRINT# to avoid this glitch.

If you get the PIE, don't be surprised when the video screen starts flashing during output to the printer. I made an anxious phone call to Lemdata and learned that it is not a fault with the PIE, and it does not hurt the PET. Later, a friend of mine said he has the same annoying flashing with his PET printer.

Whenever PET finishes printing a line, it sends a carriage return (ASCII 13) and a line feed (ASCII 10) to the IEEE bus. The line feed activates the EOI (end or identify) line on the IEEE bus. The EOI line is shared by the TV display screen blanking circuit. To prevent this flashing, end all print statements with a semicolon (;), which suppresses both the carriage return and the line feed.

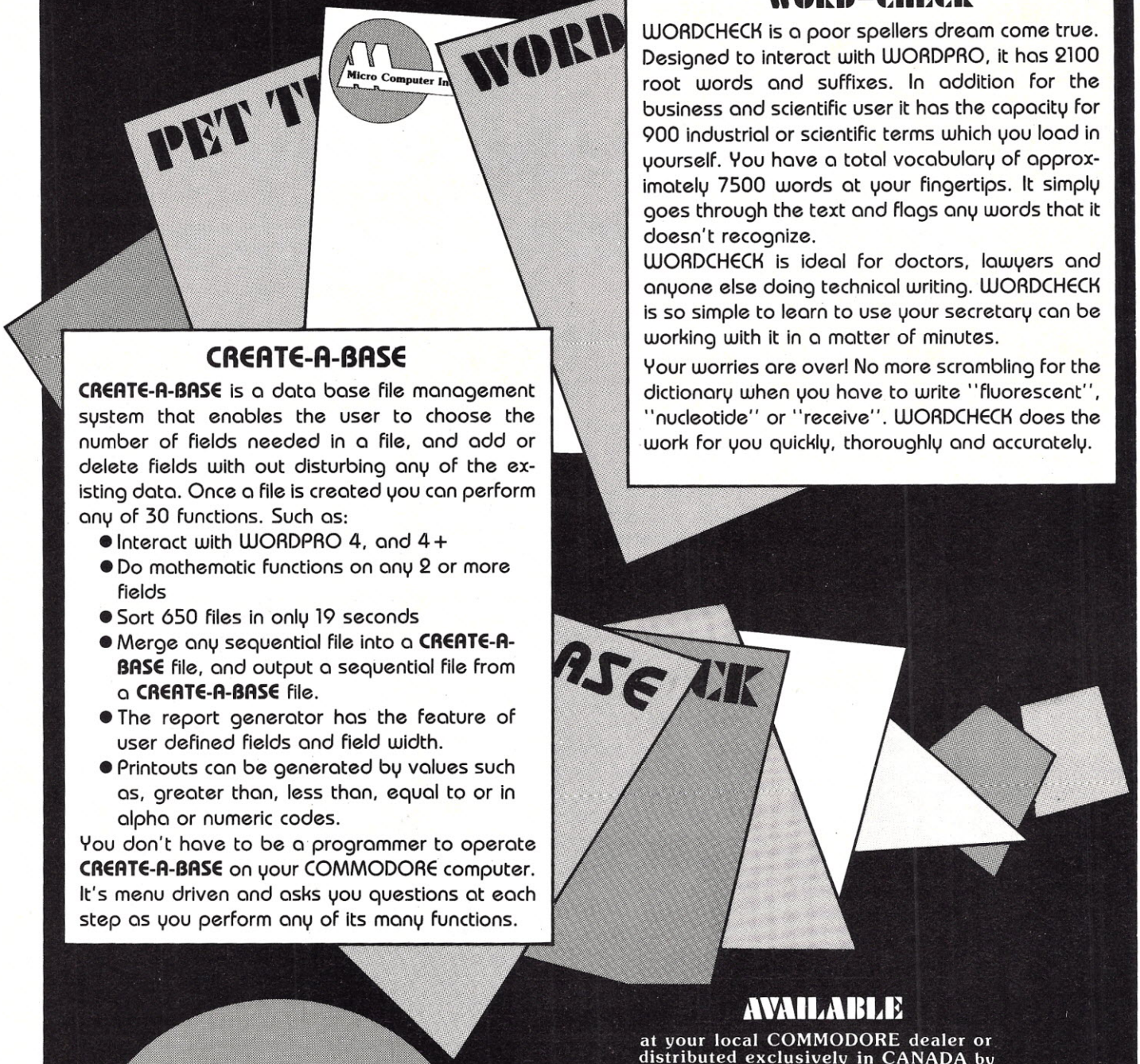
You can still supply a carriage return where needed by using CHR$(13) or a string variable which has previously been equated to CHR$(13). For example:

```
OPEN 1,4
PRINT#1,"EXAMPLE"CHR$(13)
or
CR$=CHR$(13)
PRINT#1,"USING A VARIABLE"CR$;
```

There are other approaches to connecting a parallel printer to the PET IEEE port, some of which are listed in the references, but the PIE has proven to be the right choice for me.■

References

1. "A Screen Print Machine Language Program" (for the PET User Port), Paul W. Sparks, *The Paper*, March/April '80, p. 24. For a BASIC version, see *The Paper*, August '79, p. 3. *The Paper* is out of print.
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5. "Low Cost IEEE-488 Systems Using the Commodore PET Microcomputer," Tom DeSantis, *Electronic Engineering Times*, January 7, 1980, p. 38.
6. "A Review of the SWTPC PR-40 Alphanumeric Printer," Gary Kay, SWTPC; *Byte*, March '77, pp. 18–24.
7. PET User Manual, Model 2001-8, CMD; pp. 78–79; User Port: p. 61, CLR: p. C-1.
8. PIE Instruction Manual, Lemdata Products, PO Box 1080, Columbia, MD 21044.



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A Tiger's-Eye View Of Computer Graphics

By Jim Hansen

The Integral Data Systems Models 440 and 445 printers, sold here and abroad as the Paper Tiger, are versatile and reliable. They come in two flavors: graphics and, for $99 less, nongraphics. Except for obvious mechanical differences, the two models perform identically. The graphics version of each model has a special option ROM and an expanded print buffer (2048 bytes instead of the standard 256).

Because of the special attention paid to the printer mechanism, IDS does not consider the 440 field upgradable to the 440G configuration. It would be wise, therefore, to carefully consider which model will fit your needs best before buying.

There are several reasons you might want to consider the graphics version over the standard nongraphics model, even if you never plan to use graphics.

If you want to use the printer for screen dumps from a CRT, and you want the printer to run at its maximum rate, buy the graphics model. The expanded printer buffer can allow an entire screen of data to be sent to the printer at once. Without the large buffer, it might be necessary to slow the data rate going to the printer to prevent buffer overflow, and consequential loss of data at the printer, because some CRT terminals cannot halt the screen dump once it is started. (The 440 uses the Data Terminal Ready control line to indicate its willingness to accept data. Many terminals can use this line to control the data flow during the screen dump, but many also ignore it.)

Also, since the expanded buffer lets the printer absorb data at a higher rate than can be printed, it becomes useful for obtaining hard copy from timesharing systems at data rates of up to 1200 baud where the data terminal ready signal is ignored.

Under these conditions you can get a fairly long listing with no fear of data loss, depending on the print density (the number of characters printed per inch). The 440/445 printers move the head at a constant speed and change the needle frequency to adjust the print density. The higher the needle frequency, the greater the number of characters printed per inch. Thus the throughput of the printer changes with the print density. Table 1 lists the maximum sustained throughput of the printer for the various print densities.

The information in the table will help you determine the approximate amount of time it will take to overflow the printer buffer, given that you know the buffer size and the incoming data rate. (See the equation in Table 2.) Example 1 shows the time to overflow, if a printer is set up at 1200 baud and ten characters per inch.

At 1200 baud the graphics model will print about 3840 characters (32 seconds × 120 characters/sec.) before the buffer overflows, making it practical to use in applications where the data to be listed is several pages long (depending on the length of the lines being printed). At 16.5 characters per inch, it will take 73 seconds to overflow, and print about 8777 characters.

Another often-overlooked aspect of the graphics option is what it does when you decide to buy another printer. The graphics option will no doubt make it easier to trade or sell your printer when that time comes.

Using the Graphics Mode

The graphics mode on the Paper Tiger is easy to use. But the problem of printing graphics on any printer exists here as well: it will take a lot of computer resources (both memory and processing time, particularly time, if the graphics are to be generated using an interpreter).

When people think in terms of graphics, they naturally think of such things as bar graphs, scatter plots, line drawings and the like. It seems simple to connect two points with a

Print density (characters/inch)	Maximum sustained throughput (characters/sec.)	Graphics dot density (dots/inch)
16.5	92	not recommended
12.0	67	64.2
10.0	56	51.4
8.3	45	42.9

Table 1. The maximum throughput and graphics horizontal dot density varies according to the selected print density.

Address correspondence to Jim Hansen, Methodist Hill, Lebanon, NH 03766.

$$\frac{\text{Buffer size}}{\text{Data rate (characters/sec.)} - \text{Sustained character throughput}} = \text{Time (seconds) to overflow}$$

Table 2. Buffer overflow equation.

Graphics printer: $\frac{2048}{102-56} = 32$ seconds

Nongraphics printer: $\frac{256}{120-56} = 4$ seconds

Example 1.

single line. But the truth of the matter is that it takes a lot of data to address each dot position on an 8-1/2 by 11 inch piece of paper.

Suppose you want to print a graphics image that covers the entire surface of an 8-1/2 by 11 inch page. If the printer is set for ten characters per inch, each line will print 437 dots. (The dot density in graphics at ten characters per inch is 51.4 dots per inch.) The printer vertical resolution is 72 dots per inch; 11 times 72 makes 792 lines. So you get 792 lines of 437 dots, or 346,104 dots. Thus, you need a memory array of at least 43,263 bytes to hold it all. In a 48K Apple it is plain that any graphics task of this size would be challenging. The TRS-80 will have the same problem.

Fortunately, you will probably not want to fill a whole page with dots very often, making the problem more manageable. In the meantime, screen dumps from the Apple and TRS-80 probably represent the best available solution for most people. This is probably small consolation for a lot of business users, but the problems are clear: memory size available for the graph to be stored, program and data memory requirements and program speed. Primarily because of speed, it is unlikely that any practical graphics programs will evolve using the BASIC interpreters for the entire task. Plotting programs like to manipulate bits, and, as we see, there are a lot of bits on a single page. Some, if not all, of a practical graphics program will have to use either compiled code or be written in assembly language.

If you feel that screen dumps from your Apple, Exidy or TRS-80 might be useful, they are available. I am aware of three sources of screen dump programs for the Apple: Computer Stations, Computer Forum and Call-Apple. Call-Apple, an Apple user's group, has published information on screen dumps in their bulletin during the past year. I have used the Computer Station programs, and find that they work as advertised without a hitch. It is priced at nearly twice Computer Forum's, which I haven't tried, but looks more difficult to use.

The only screen dump package for the Exidy that I am aware of is the Super Graphic Scratch Pad sold by a Canadian firm called Northamerican Software. I have not seen it run, but they describe a host of very interesting features, including the ability to save several screens of information and flash them by to give some animation effects. It is an interesting package, and Exidy owners should be aware of it.

The TRS-80 has but one screen dump program that I know of, and it is available through IDS dealers. It is sold on a tape, along with a copy of their application note AN-8012. The tape has a copy of the screen dump for both disk and nondisk systems on one side, and the program that prints the Tiger on the other. It automatically locates itself to the top of whatever memory is available, resets the high memory pointer, patches in a new line printer driver and returns to BASIC or DOS, depending on which of the two versions was loaded. If you are running Apparat's NEWDOS, the JKL screen dump command still works, but is much faster, since empty lines and trailing spaces are skipped. The screen dump itself intermixes both graphics and text, just as it appears on the TRS-80 screen. A dump can be triggered from BASIC programs or directly from the keyboard.

I haven't seen or heard of any printer output package for the PET, but there must be one somewhere.

Doing It Yourself

Those of you who are interested in doing your own thing in graphics might want to drop a note to your IDS dealer and request information on the application notes for the 440/445 printer that relate to your particular computer. Most are on various aspects of using the TRS-80 and Apple, but there are a number of notes that talk about graphics in general and apply to everyone.

The following discussion will describe the details of getting the printer into and out of graphics, as well as some of the pitfalls that you will encounter along the way. I have chosen to describe the I/O control codes in a BASIC-like manner so that the majority of you will be able to easily grasp what is required. Advanced readers can use hexadecimal, binary or anything else equivalent that best suits your needs. My programming examples are in TRS-80 BASIC.

Before you begin to use the graphics option on your printer, enable the graphics option by making sure that switch 6 of DIP switch 3 (the right-hand one) is in the on position, toward the front of the printer. Remember that the switch must be set before the printer is turned on, since the option switches are only scanned during the power-up sequence of the printer.

When powered up in this configuration, the printer will still print normally, but will now respond to con-

Line feed	CHR$(3);CHR$(10);
Vertical tab	CHR$(3);CHR$(11);
Form feed	CHR$(3);CHR$(12);
Carriage return	CHR$(3);CHR$(13);
Enhanced mode	CHR$(3);CHR$(01);
Normal mode	CHR$(3);CHR$(02);
8.3 characters/inch	CHR$(3);CHR$(28);
10 characters/inch	CHR$(3);CHR$(29);
12 characters/inch	CHR$(3);CHR$(30);
Deselect printer	CHR$(3);CHR$(19);
Select printer	CHR$(3);CHR$(17);
Data CHR$(3)	CHR$(3);CHR$(03);

Table 3. When in the graphics mode, the above functions can be activated by the two-character sequence shown. The codes are the same as used in the normal mode, but preceded with CHR$(3);. Notice that when CHR$(3) is to be output as data, it too must be preceded by CHR$(3);.

```
10 N=2*N                          *Shift the bits
.
.                                 *Assemble all the Ns into a string somehow
.
100 LPRINT N$;CHR$(3);CHR$(11);   *Print the string and end it with a vertical tab
```

Listing 1.

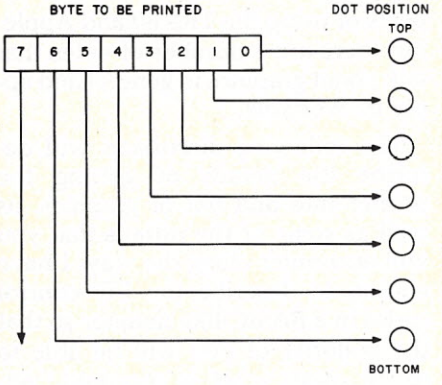


Fig. 1. While in the graphics mode, the 440G printer prints a single dot for each bit set in the bytes sent to it. The bit-to-dot mapping is shown above. If the printer were set for a character density of ten CPI, it would take about 54 bytes to print a line one inch long in the graphics mode.

trol codes that can change the character density (number of characters per inch), form lengths and select the graphics mode.

Before printing graphics, it would be a good idea to select the character density you wish under program control. The printer cannot print graphics in the 16.5 character-per-inch mode because the required needle frequency is so high that the printer controller runs out of time. Ten characters per inch is a good figure to use, and can be selected by the following line of BASIC code:

```
10 LPRINT CHR$(29);
```

Other character densities can be selected as well; the control codes that are used by the 440/445 graphics printers while in the graphics mode are listed in Table 3.

The graphics mode is selected by sending the printer a CHR$(3);. Be sure to place a semicolon after the print statement, or your computer will tack on a carriage return/line feed sequence as a part of the print statement. They will be accepted by the printer as graphics characters, and printed as such along with the data you really wanted.

Characters that are sent to the printer are normally printed as a vertical column of up to seven dots. Bit 0, the LSB of the byte sent from the computer, will appear at the top of the column, and bit 6 will reside at the bottom. A "one" in any bit position will cause a dot to be printed. (See Fig. 1.)

Thus, CHR$(1) will print the top dot of a vertical column of seven dots, and CHR$(64) will print a dot at the bottom. CHR$(127) will print all seven dots.

Normally you would not want to print more than six dots high, since the seventh dot will be overstruck by the top dot of the next line printed. Each byte that is sent to the printer while it is in the graphics mode will cause another vertical column to be printed; thus, the width of the output will be a function of the character density and number of characters sent in each line.

Only a line terminator will cause the printer to print the data stored in the print buffer. In fact, if the print buffer is filled with no line terminator in the buffer itself, the printer will hang up and have to be powered down before it will ever print again.

In the normal mode, a line terminator is a carriage return, line feed, vertical tab or form feed. The graphics mode uses the same codes but precedes each by a CHR$(3);. Don't forget the semicolon! A sequence to print the current line and advance the paper up six dots (the function of a vertical tab) would be:

```
10 LPRINT CHR$(3);CHR$(11);
```

The proper code for a carriage return, line feed or form feed can be substituted for the CHR$(11);. Additionally, the return to normal mode (CHR$(2)) can be used as a line terminator when in the graphics mode.

Since CHR$(3) is considered the "escape" code for the printer, it is somewhat of a hassle if you want to print a CHR$(3), the two upper dots. The issue can be resolved in three ways.

First, you can trap the 3 and never send it. This is obviously not acceptable. The second method is to use a routine equivalent to:

```
10 LPRINT CHR$(N);
20 IF N=3 THEN LPRINT CHR$(N);
```

where N is the byte to be output.

The effect of this routine is to send out a pair of CHR$(3)s whenever they are considered data, instead of an escape code. A third possibility is to shift the bits to the next higher position. This way, there is no possibility of sending a 3 to the printer. The ob-

```
10 REM PROGRAM TO DEMONSTRATE GRAPHICAL OUTPUT ON THE IDS 440G
15 LPRINT CHR$(29);"THE FOLLOWING IS A STRING OF GRAPHICS";
16 LPRINT CHR$(10);CHR$(10)
17 LPRINT CHR$(3+128);
20 FOR N=1 TO 3
30    FOR O = 0 TO 127
35       P = (2*O) + 128
36       IF P>255 THEN P=P-128
40       LPRINT CHR$(P);
50    NEXT O
55 NEXT N
60 LPRINT CHR$(3);CHR$(2)
70 LPRINT CHR$(10);CHR$(10);CHR$(10)
80 END


THE FOLLOWING IS A STRING OF GRAPHICS
```

Program listing and sample run. Demonstrates control of the 440 graphics printer. Line 15 prints a message, line 16 line-feeds the printer twice, and line 17 places the printer in the graphics mode. The loop starting at line 30 outputs ascending binary numbers 0 to 127_{10} twice for each pass through the loop. These numbers are sent to the printer byte by byte after being shifted and scaled to a value less than 256. Line 60 returns the printer to the normal mode. The ascending binary count is plainly visible in the output. It took about 11 seconds for the program to run to completion. The printer was busy perhaps 1/10th of a second. If an interpreter is to be used in graphics, efficient coding (this is not an example) must be used to minimize run times.

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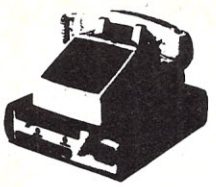
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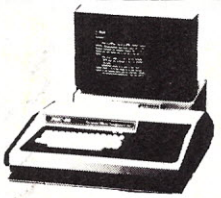
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vious side effect is that the graphics field will be shifted down the page one dot position when compared to a normal character. Another advantage of this technique is that the data, once shifted, can be sent directly to the printer using a string output function. An example of the general method is conceptually shown in Listing 1. The precise techniques for string assembly will vary from one BASIC to the next.

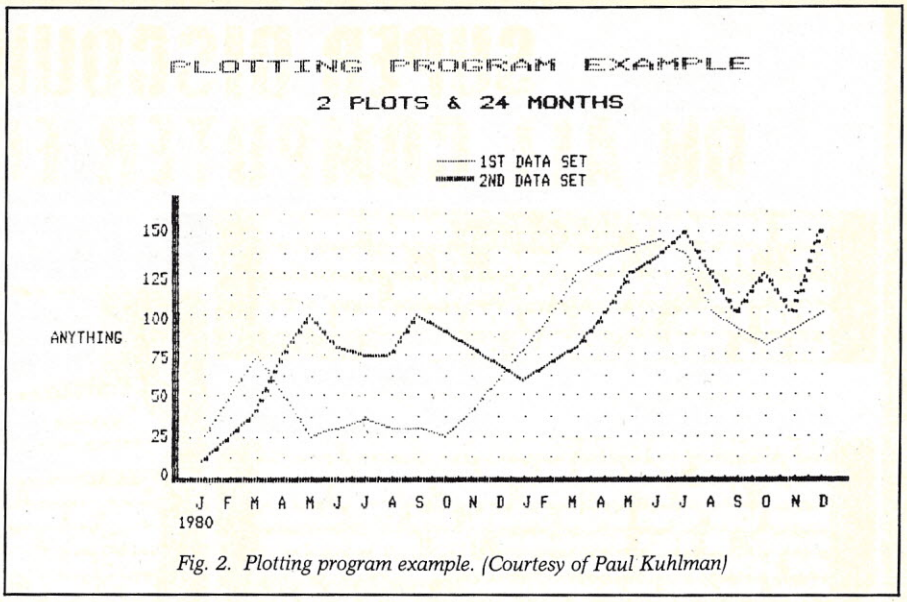


Fig. 2. Plotting program example. (Courtesy of Paul Kuhlman)

Impediments

The actual output firmware in most existing computers such as the Apple and TRS-80 must be carefully scrutinized before you dare try outputting graphics using the various PRINT or LPRINT statements. This is because in every system I have used, some characters will be trapped, and either replaced with one or more different characters or not sent at all. In other cases, the automatic line width control must be defeated or a carriage return/line feed sequence will be output in the middle of a graphics string.

The Apple line printer firmware traps a single character (normally a control I, CHR$(9)) and carefully tends the number of characters per line. If your Apple graphics program is to use the Applesoft print routines, you will want to defeat the trap character and reset the character count each time a graphics character is output.

If your printer is connected to slot 1 in the Apple, the character counter can be reset with:

```
10 POKE 2041,30
```

The 30 is just a random number between one and the maximum line width. The procedure for patching the control I to some other code is given in the Apple parallel printer interface handbook.

The TRS-80 gets into the act in a more vigorous manner. It traps and discards all nulls (CHR$(0)), appends a carriage return to all line feed codes (CHR$(10)), replaces a vertical tab (CHR$(11)) with a carriage return and line feed and replaces all form feeds (CHR$(12)) with a series of line feeds.

Two tricks can be used to get around the Apple control I and TRS-80 character-trapping problem. One is to simply add 128 to each character to be output. This has the effect of setting the high-order bit in each byte. The firmware will not find a match for trapping, and pass the character untouched. The 440/445 printers will discard the high-order bit, and handle the characters in the normal fashion.

The other way around the problem is to write your own character output routine in assembly language. For instance, all the data values could be shifted left (multiplied by two) in a single machine-language instruction, avoiding the CHR$(3) problem, and then be output with about four or five more instructions. The major problem here is the clumsy way some BASICs allow machine code routines to be called.

The thing to watch for if using a BASIC interpreter is speed. If you can do any of your work in machine code, by all means do it. Let BASIC do the legwork, but use machine code wherever bits are being shifted around or characters are being sent to the printer. This will speed things up considerably.

As can be plainly seen, if you do not want to use a commerical screen dump program you will need to carefully explore your computer system before graphics code can be confidently sent to the printer. Once this plateau has been reached, the next problem will be to write a graphics generator that will take commands or points from a file or other program and make whatever arrangements are needed to get them processed and sent to the printer.

This is not a trivial feat, but it can be done. Fig. 2 shows the output of an early attempt to output a graph built entirely from a program. The program was written on a TRS-80 in BASIC and the listing was about four feet long. It was also slow, but could probably be speeded up by a factor of three to five using compilers now available. Even more compact and faster code will result if the program is written in assembly language.

It is only a small step, once graphics output of the type shown in Fig. 2 is done, to make your Paper Tiger into a line plotter. If there is sufficient interest, more could be said about this project. In the meantime, happy graphing!■

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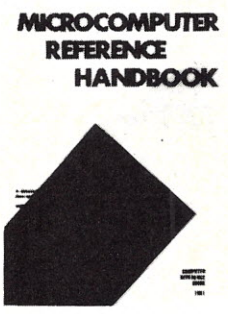
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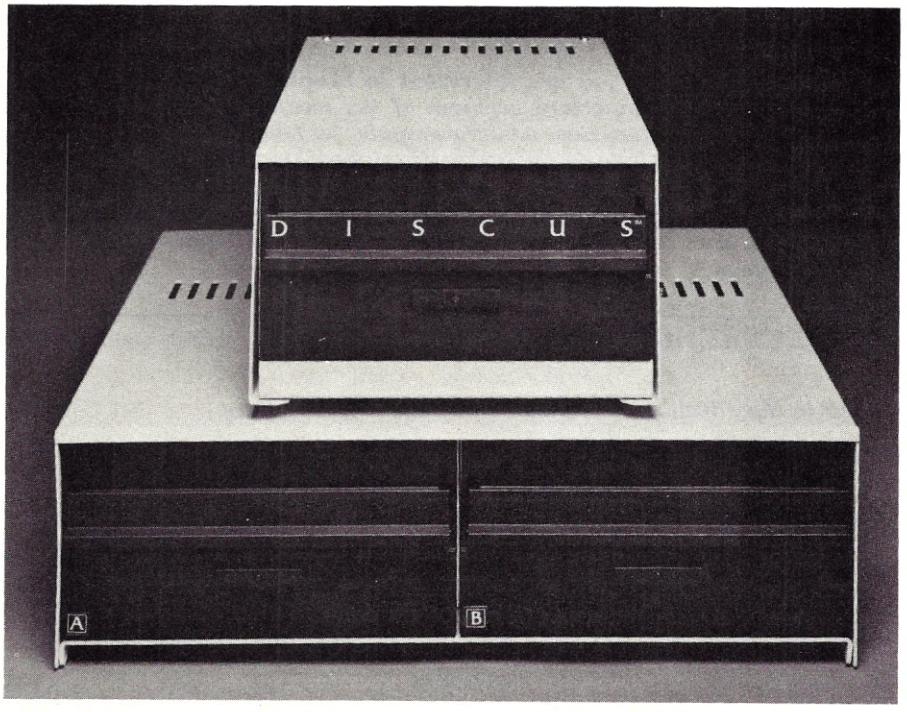
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I held out for a while but finally went ahead and ordered the 2D controller board. That and a special double-density version of CP/M were all I needed to bring my Z-2 computer back up in the double-density configuration. As it turns out, the increase in disk storage capacity is only one of several advantages to the new system.



The Discus 2D disk operating system offers twice as much storage on one disk. (Photo courtesy Morrow Designs)

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The Master Catalog, by the way, is outstanding and the only way to keep track of the programs on your disks. It is available from Elliam Associates, 24000 Bessemer St., Woodland Hills, CA 91367, for $10 on an eight inch single-density diskette. Every CP/M user should have a copy.

Hardware

Just about everything that I mentioned in my Discus I article applies to the 2D controller. However, it uses the Western Digital 1791 disk controller chip for increased efficiency, and is available in kit or assembled form (ThinkerToys, 5221 Central Ave., Richmond, CA 94804). The RS-232 parameters for the onboard serial port, such as baud rate, character length and stop bits, are switch-controlled so that the board can be quickly set to match your particular serial terminal. It can also feed 20 mA serial devices such as the Model 33.

My NEC Spinwriter, which has a Diablo-compatible serial interface,

Address correspondence to Rod Hallen, State Department—Accra, Washington, DC 20520.

normally works through a separate I/O board, but was easily switched to the 2D controller. With the proper switches set, the drive cable plugged in and the special double-density version of CP/M in the first drive, I powered up the system and was in business that quickly. It couldn't have been simpler.

DISKATE

Discus 2D includes an enhanced version of DISKATE, which, as I discussed in my previous article, is ThinkerToys' proprietary disk-operating software. Version 2.0 has some added commands and increased block size, and will work with double-sided as well as single-sided drives. Also part of the package is Virtual BASIC.

CP/M

Available as an option is Lifeboat Associates' double-density CP/M. This is the DOS that I use, and it has all of the features of standard CP/M, plus a few new ones.

First and foremost of these is the DENSITY command, which lets you intermix single- and double-density disks. It also tells you whether a given disk is recorded in single- or double-density format and the present density condition of each drive in the system. You can change the density of any drive at any time and can copy from single- or double-density disks or vice versa. This makes for very flexible operation.

Whenever 2D is powered up, it will initialize with drives A, C and D set for double-density and drive B set for single. You can make a simple modification to the I/O driver that will set the density configuration any way that you want. The original setup was great for converting all of my disk files to double-density, but now I have the system come up with both of my drives set for double-density. I can always use the DENSITY command to reset one or the other to single when I have a single-density disk to read or write.

When you initially fire up 2D, your existing disk library (if you have one) will probably be recorded in single-density format. But it is relatively easy to convert it to double-density. With a dual drive system you use the DENSITY command to set drive A for double-density and drive B for single. Insert the single-density disk that you want to copy in drive B and a double-density disk in drive A. The CP/M PIP command (PIP A:=B:*.*) can then be used to move programs, and they will automatically be converted to double-density as they are recorded on drive A. A SINGLE command is provided to do the same operation on single-drive systems.

The FORMAT command lets you initialize a diskette in either single- or double-density format. This should never be used on a disk that contains software that you wish to retain, since the files on the disk will be totally erased in the formatting process. Be sure to make a backup copy first.

An updated DIR command called LIST is also provided. LIST will cause the disk directory to be displayed in horizontal format so that it does not scroll off the screen as long DIR displays do.

COPY will duplicate disks when two or more drives are used. It will not, however, copy from single- to double-density. It can also be used with single-drive systems in conjunction with the SINGLE command.

Because of a compatibility problem, some single-density disks cannot be read by 2D in their original format. A REGEN command is used on these disks to read a track at a time into memory where the formatting is corrected; then the track is written back on the disk. It is still a single-density disk, but it is now readable by Discus 2D. About six of my disks fell into this category, but REGEN quickly fixed them up.

AUTO is a very interesting command. It is not a CP/M command in the usual fashion; instead, it is used to invoke a program automatically upon a cold or warm start. For instance, if you rename LIST.COM AUTO.COM (REN AUTO. COM=LIST.COM), then the disk directory will be displayed whenever a warm start (control-C) is initiated after changing disks. Or BASIC.COM could be renamed AUTO.COM on your BASIC disks; then it would be loaded and executed with each cold or warm start.

AUTO can also be used to load long I/O drivers. As an example, the driver routine for my Malibu 160 line printer was almost 2K long and wouldn't fit within the area of CP/M set aside for I/O, so I had to load it with DDT each time that I wanted to use the printer. With AUTO it would be loaded each time that the power was turned on.

Those of you who are familiar with CP/M know that the interface between CP/M and the hardware that it runs on is called the Custom BASIC Input-Output System, or CBIOS for short. The CBIOS supplied with the 2D version of CP/M is, of course, designed to work with the 2D disk controller and its serial port. This takes care of the keyboard and screen of a video terminal. But what about other peripherals, in particular a printer, or in my case a memory-mapped video interface board, the Imsai VIO-C? It is easy to rewrite CBIOS to fit your needs. Ten minutes after I first powered up 2D, my screen came alive.

Two different CBIOS routines, which are called USER and TTUSER, are provided. The first is a simplified routine and best used by those who are new to CP/M. You can move up to TTUSER, which has a more flexible I/O structure, when you have gained a little experience. All you need to do is rewrite USER so that it will access your peripherals and then use MOVCPM, DDT and SYSGEN to merge your new CBIOS and CP/M. Complete instructions are given, but this could prove difficult for those who are not familiar with assembly-language programming.

If your original system consists of a serial video terminal or KSR, then you won't have to worry about any of this. Just connect it to the controller serial port, and the software is ready to go. You can add peripherals later.

As supplied, 2D CP/M is designed for 24K memory. If you have more than 24K, you will want to increase its size so that larger programs can be run. This is done in the same manner as the CBIOS modification and is explained in the manual. This is easier to do than was the case with my original version of CP/M and does not require assembly-language programming experience.

I am now using 56K and would go even larger except that my top 8K is occupied with the Discus controller at E000H and the Imsai VIO-C video board at F000H. You may think 56K is a lot of memory until you consider that my Pascal compiler requires that much as a minimum. I guess it is time to start thinking about memory bank switching. The 2D controller can be deselected so that it can co-reside in memory with RAM, but I haven't figured out the details yet.

To initiate a cold start, which means to power the system up, it is necessary to execute address E000H. You can do this from front panel switches, with a ROM-based monitor

or a power-on-jump. My Cromemco Z-2 ZPU has address switches which I set for E000H; each time the system is turned on or the reset button is pressed, a jump is made to the beginning of Discus 2D and CP/M is automatically loaded. Although I haven't used DISKATE very much yet—all of my disks are recorded in CP/M format—DISKATE should come up in the same fashion. If you don't have a CPU board with power-on-jump circuitry, the Discus 2D controller board will provide it.

Disks

It might be worthwhile, at this point, to talk about diskettes and some of the things that I have discovered. I started with single-sided single-density diskettes such as the Verbatim FD 34-1000 and the Scotch 740-0. Both worked well, and I have never had any disk I/O problems which I could trace to the diskettes themselves.

Then I read somewhere that you could use both sides of a disk if you punched new openings so that the index hole was in the proper position when the disk was placed in the drive upside down. This worked fine with the Scotch disks but not the ones from Verbatim. Maybe the magnetic coating on the back side wasn't good enough. But since they are not intended to be used this way, you can't very well blame Verbatim. Then I came across reversible diskettes from Key, which accomplish the same thing.

My first question upon ordering my Discus 2D had to do with the increased density of recording: "Would the disks rated for single-density handle the more compact code?" To be sure, I ordered three double-density-rated disks just in case. However, while it is not recommended that single-density diskettes be used for the double-density recording, I have not had any problems.

I did run into one difficulty though: there are two different types of double-sided disks. One is the reversible disk that I have just mentioned. It is intended to be used in single-sided drives and is turned over by hand to gain access to the second side. It cannot be used in a double-sided drive.

The true double-sided diskette has the openings for reading the index hole placed differently and cannot be used in a single-sided drive. I use the double-sided reversible disks with my system.

Conclusions

One difference that I've noticed between Discus I and 2D is the transfer of data in a two-drive system. With Discus I the system jumps between drive A and drive B so rapidly that the heads being loaded sound like a machine gun. This was particularly noticeable when reading files from the drive that was not logged in. This apparently has something to do with the length of each block of data that is written or read. The machine-gun effect is not present with 2D.

One very pleasant improvement that 2D makes over Discus I is speed. Because data is packed twice as densely on the disk, reads and writes seem to be twice as fast. This is especially welcome when loading or saving long files. The 2D controller is designed to run with either 2 or 4 MHz 8080, 8085 or Z-80 CPUs, but a couple of my memory boards won't handle the higher speed. If they would I'd get an even greater increase in operating speed.

Another question that came to mind early was whether all of my existing software would run OK with the 2D and the Lifeboat Associates double-density version of CP/M. I am happy to say that, except for one minor problem, everything works fine. This includes such programs as the Electric Pencil II, Magic Wand, Microsoft Extended Disk BASIC, Pascal/M, Pascal/MT and a whole lot more.

The only difficulty developed with a directory display program called XDIR that lists the directory in alphabetical order and in horizontal format, along with the size of each program. I like this display best of any that I've seen. After taking it apart, I found that it was reading the directory sectors directly; they are not recorded in the same sequence with 2D as with the single-density version. No other problems have shown up, and once you are up and running, the only noticeable difference between the two versions of Discus is the speed of disk I/O and the increased storage capacity of each diskette.

If you put a single-density-formatted disk in a drive set for double-density or vice versa and try to read or write it, the head will seek and load continuously, but nothing else will happen. To get out of this loop, you must load a double-density system disk in drive A and reset. No damage will be done to the disk that was used erroneously, but you will lose whatever is in memory when you reset.

Upon rereading what I have written, I find that I've devoted a lot more text describing CP/M than I did talking about the 2D controller itself. But this is how the system strikes me. The hardware is in the background, and it is the software that the user actually deals with.

The advantages of the Discus 2D are well worth the difference in cost between it and Discus I. However, ThinkerToys is now tempting me again, this time with double-density, double-sided drives, and even hard disks. Both of these configurations come with the new CP/M version 2.0. Here we go again! Where will it ever end—or will it?■

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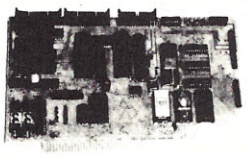
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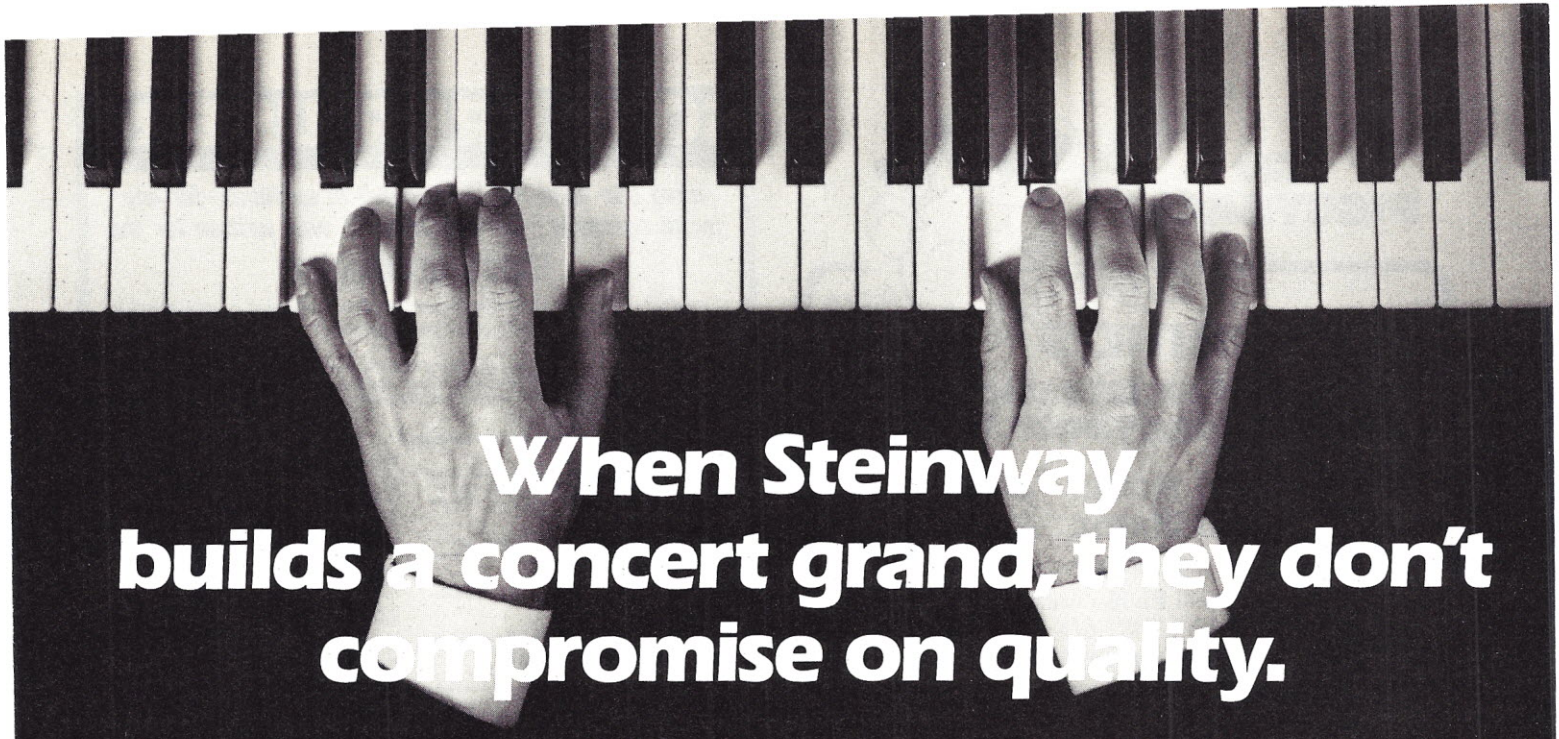
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This allows you to edit your program just as if you were using the Wordprocessor Pac. All the same numeric keypad commands are used. You may even have Basic program lines over 500 characters long!

AUTO [xx[,yy]]
While entering program lines, each new line number is typed for you! All the EDIT commands are available in this mode, which greatly speeds program writing.

REN [a[,b[,c[,d]]]]
You may renumber all or a section of your program with one simple command.

TRACE [xx[,anything]]
This command runs your program and prints each line number on the screen after it is executed. You may optionally print values of numeric or string variables after each line number.

HELP xx
How many times have you got a 'SN ERROR IN LINE xx' message but could not see the error? This command prints the program line in EDIT mode and places the cursor over what System 3 thinks is the error! This command is especially useful with your now very long program lines.

FIND["] anything
Find and list all program lines containing 'anything'. An optional wildcard character may be included.

DEF x
You may define function keys with this sophisticated routine, which even includes an input feature.

VAR
List all variables and their values. This is often used after a program run.

LIST [xx[,yy]
List all program lines from xx to yy.

DEL [xx[,yy]
Delete all program lines from xx to yy.

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Erase all spaces in your program excepting those within quote marks and in REM statements.

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General Instrument hits the right note with its programmable sound generator to liven up PET programs.

Soulful Software Sounds

By Raymond J. Bell

General Instrument Corp. has a new IC called a programmable sound generator (PSG). This unique chip, part number AY-3-8910, can generate various sounds by having a processor write control words into its internal registers. All changes are done through software.

Chip Capabilities

The chip can generate three separate analog channels of sound for musical chords and other complex effects. Each channel can be selectively enabled. Their amplitudes can be under direct processor control or under control of an envelope generator. You can selectively enable noise at a selected frequency onto each analog channel. Finally, the chip provides two 8-bit user ports, so you can interface this chip to the PET and still have plenty of I/O left over for joysticks or other specialized game interfaces.

The chip appears as 16 external memory registers that are eight bits wide. Each register can be read from or written to (see Table 1). General Instrument uses octal notation, but I changed everything over to decimal or hexadecimal.

Register pairs R0 and R1, R2 and R3 and R4 and R5 set the tone frequency for each of the three channels by acting as programmable dividers. The output frequency in each case is given by:

Fo = fclock ÷ (16 (R1R0))

The upper four bits in R1, R3 and R5 are not used. This gives a 12-bit divisor. The lower five bits of R6 determine the frequency of the noise source. Its frequency is calculated the same way. The upper three bits are unused.

R7 is the enable register. The bits are defined as follows (when bit = 0):

B0	Enable tone on channel A
B1	Enable tone on channel B
B2	Enable tone on channel C
B3	Enable noise on channel A
B4	Enable noise on channel B
B5	Enable noise on channel C
B6	Enable input on I/O port A
B7	Enable input on I/O port B

Registers R8, R9 and R10 control the amplitude for each channel. The lower four bits (B0–B3) allow direct processor control of amplitude. If bit 4 = 1, the amplitude is controlled by the envelope generator.

Registers R11 and R12 control the envelope frequency, which is given by:

fe = fclock ÷ (256 (R11R12))

Here all 16 bits in both registers are used.

Register R13 controls the envelope shape. Only the lower four bits are

REGISTER		BIT B7	B6	B5	B4	B3	B2	B1	B0
R0	Channel A Tone Period	8-BIT Fine Tune A							
R1		4-BIT Coarse Tune A							
R2	Channel B Tone Period	8-BIT Fine Tune B							
R3		4-BIT Coarse Tune B							
R4	Channel C Tone Period	8-BIT Fine Tune C							
R5		4-BIT Coarse Tune C							
R6	Noise Period				5-BIT Period Control				
R7	Enable	IN/OUT		Noise			Tone		
		IOB	IOA	C	B	A	C	B	A
R8	Channel A Amplitude				M	L3	L2	L1	L0
R9	Channel B Amplitude				M	L3	L2	L1	L0
R10	Channel C Amplitude				M	L3	L2	L1	L0
R11	Envelope Period	8-BIT Fine Tune E							
R12		8-BIT Coarse Tune E							
R13	Envelope Shape/Cycle					CONT.	ATT.	ALT.	HOLD
R14	I/O Port A Data Store	8-BIT PARALLEL I/O on Port A							
R15	I/O Port B Data Store	8-BIT PARALLEL I/O Port B							

Table 1. PSG register array.

BDIR	BC1	Operation
0	0	PSG inactive
0	1	read PSG register
1	0	write PSG register
1	1	latch address

Table 2.

Address correspondence to Raymond J. Bell, RD 1, Landenberg Manor, Landenberg, PA 19350.

Listing 1. PSG Sound Generator driver.

```
033A            1 !
033A            2 !  PSG DRIVER
033A            3 !  29DEC79 R.J. BELL
033A            4 ! RAM ALLOCATION
0050            5         *=$50
0051            6 REG     *=*+1
0052            7 DATA    *=*+1
0052            8 !  I/O
E822            9         *=$E822
E823           10 CNTRL   *=*+1
E843           11         *=$E843
E844           12 DDR     *=*+1
E84F           13         *=$E84F
E850           14 PORT    *=*+1
E850           15 !  EXECUTABLE CODE
033A           16         *=$33A
033A A551      17 WRITE   LDA DATA    !GET USER
033C A202      18         LDX #$02    !WRITE PSG
033E D009      19         BNE WRTPIA !FORCED
0340 A550      20 LATCH   LDA REG     !GET REG #
0342 A2FF      21         LDX #$FF    !SET DDR TO
0344 8E43E8    22         STX DDR     ! OUTPUT
0347 A203      23         LDX #$03    !SET UP
0349 8D4FE8    24 WRTPIA STA PORT    !SEND ADDR
034C 8E22E8    25         STX CNTRL  !LATCH IT
034F D00E      26         BNE EXIT    !FORCED
0351 A200      27 READ    LDX #$00     !SET DDR FOR
0353 8E43E8    28         STX DDR      !INPUT
0356 E8        29         INX          !SET UP
0357 8E22E8    30         STX CNTRL    ! TO READ
035A AD4FE8    31         LDA PORT     !READ DATA
035D 8551      32         STA DATA     !SAVE IT
035F A200      33 EXIT    LDX #$00     !DISABLE
0361 8E22E8    34         STX CNTRL    ! PSG
0364 60        35         RTS
0365 204003    36 GETREG JSR LATCH   !SET UP ADDR
0368 205103    37         JSR READ    !GET DATA
036B 60        38         RTS
036C 204003    39 WRTREG JSR LATCH   !GET ADDR
036F 203A03    40         JSR WRITE   !SEND DATA
0372 60        41         RTS
0373           42         .END
```

defined. These bits work together to yield various combinations of attack and decay of sound.

Once you set up a particular sound, the PSG will continue to make that sound without any further intervention on the part of the PET.

Finally, R14 and R15 read/write to I/O ports A and B, respectively. All bits in one I/O register must be set up as all input or all output.

Eight multiplexed address/data lines (DA0–DA7) and two control lines (BC1 and BDIR) accomplish communication with the chip. You write (or read) a register by first writing the lower four-bit address and latching it. This selects one of the 16 registers. Then you can send the data to or from that register. Lines BC1 and BDIR on the chip control this as in Table 2.

Circuit Construction

But I wanted to interface the chip directly to the PET user port, which only has eight lines available. So I used two lines on the IEEE interface on the PET as the control lines and used the user port for the address/data lines. See the circuit in Fig. 1.

The 74LS04 teams up with an inexpensive 3.579 MHz color TV crystal to form a simple TTL oscillator. The resulting frequency is divided by two by one-half of a 74LS74 flip-flop to give 1.789 MHz, as the maximum clock rate for the PSG is 2 MHz. You should use this frequency because the PSG software assumes this frequency and color TV crystals are cheap and available.

If you want another frequency, make sure you change the appropriate register values, and stay in the range of 1 to 2 MHz. Connect lines DA0–DA7 on the chip to PA0–PA7 on the PET user port. BC1 and BDIR go to pins 1 and 2, respectively, on the IEEE connector. Tie analog channels A, B and C to the input of an LM386 audio amplifier. You can use wirewrap techniques; layout is not critical. I used two pieces of ribbon cable, each connected to a 24-pin edge connector.

Software

The software driver for the PSG is given in Listing 1. I assembled the machine code to reside in the second cassette buffer at location $33A(826). Locations 80 and 81 in RAM—register number and data, respectively—provide the interface to BASIC. These locations work well on the old PET—I'm not sure they will work on new PETs.

To write to the PSG in BASIC, POKE the register number in 80 and the data value in 81 and execute SYS (876). To read a register, POKE the

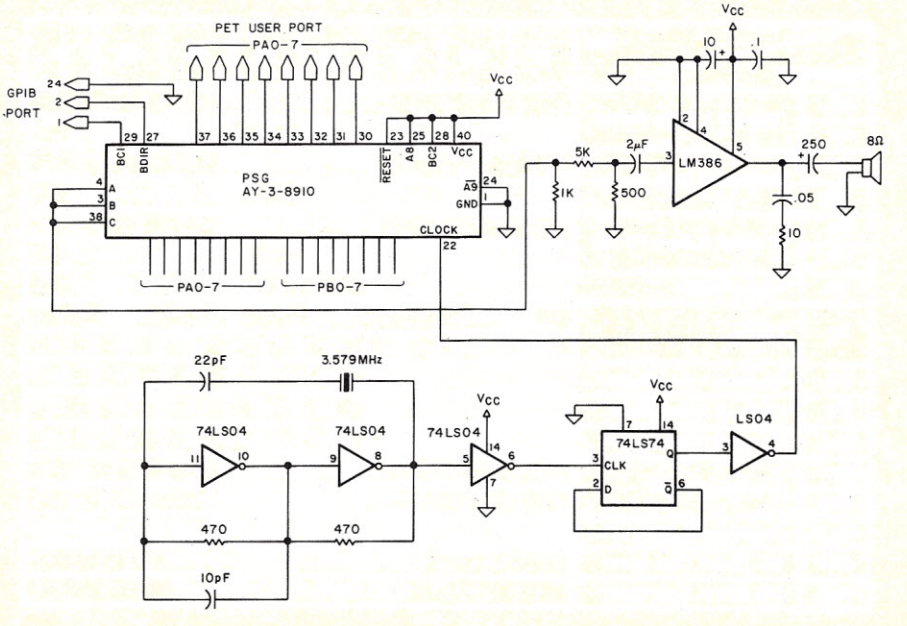


Fig. 1. Programmable sound generator—PET interface.

Listing 2.

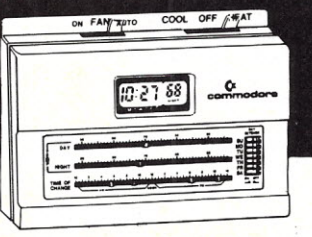
```
5 REM PSG DEMO PRGM 2JAN80  R.J. BELL
8 REM FOR OLD PETS
10 GOTO3000
20 PRINT"WHICH EFFECT:  0=QUIT"
30 PRINT"               1=SIREN"
40 PRINT"               2=BOMB"
50 PRINT"               3=EXPLOSION"
60 PRINT"               4=WOLF WHISTLE"
70 PRINT"               5=PHASERS";:INPUT I
80 I=INT(I)+1:IF I<0 THEN I=0
85 IF I>6 THEN 20
90 ON I GOTO 95,100,200,300,400,500
95 END
99 REM SIREN EFFECT
100 GOSUB 1000
105 REM SELECT 440 HZ ON CH. A
110 R=0:V=254:GOSUB2000
120 R=1:V=0:GOSUB2000
125 REM ENABLE CH A
130 R=7:V=62:GOSUB2000
135 REM MAX. AMPLITUDE ON CH. A
140 R=8:V=15:GOSUB2000
145 REM SOFTWARE WAIT LOOP
150 FORI=1TO450:NEXT
155 REM SELECT 187 HZ
160 R=0:V=86:GOSUB2000
170 R=1:V=1:GOSUB2000
180 FORI=1TO550:NEXT
190 GETA$:IFA$=""THEN110
192 R=8:V=0:GOSUB2000
195 GOTO20
199 REM BOMB WHISTLE EFFECT
200 GOSUB1000
210 R=7:V=62:GOSUB2000
220 R=8:V=15:GOSUB2000
225 R=0
230 FORV=48TO192
235 REM DO FREQ. SWEEP ON CH. A
240 FORI=1TO4:NEXTI
250 NEXTV
260 R=8:V=0:GOSUB2000
299 REM EXPLOSION
300 GOSUB1000
305 REM SELECT NOISE PERIOD
310 R=6:V=0:GOSUB2000
315 REM ENABLE NOISE
320 R=7:V=7:GOSUB2000
325 REM ENABLE ENVELOPE GENERATOR
330 R=8:V=16:GOSUB2000
340 R=9:GOSUB2000
350 R=10:GOSUB2000
355 REM SELECT ENVELOPE PERIOD
360 R=12:V=56:GOSUB2000
365 REM SELECT DECAY MODE FOR ENV. GEN.
370 GOTO20
400 GOSUB1000
405 R=6:V=1:GOSUB2000
408 REM ENABLE NOISE ON CH. B
410 R=7:V=46:GOSUB2000
415 R=8:V=15:GOSUB2000
420 R=9:V=9:GOSUB2000
422 R=0
424 REM DO FREQ. SWEEP
425 FORV=64TO32STEP-1
430 GOSUB 2000
432 FORI=1TO12:NEXT
435 NEXT
440 FORI=1TO150:NEXT
450 FORV=64TO48STEP-1
452 GOSUB2000
455 FORI=1TO25:NEXT
458 NEXT
460 FOR V=48TO104
462 GOSUB2000
465 FORI=1TO6:NEXT
468 NEXT
470 R=8:V=0:GOSUB2000
480 R=9:GOSUB2000
495 GOTO20
499 REM PHASER PHIRE
500 GOSUB1000
505 R=6:V=11:GOSUB2000
```

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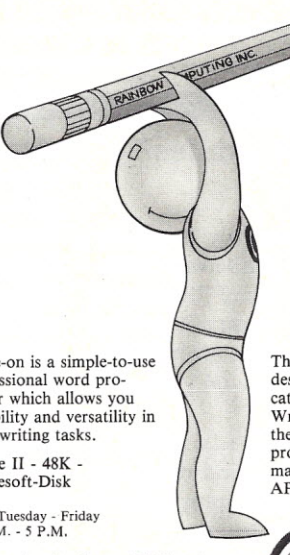
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Listing 2 continued.

```
  508 REM ENABLE NOISE & TONE
  510 R=7:V=54:GOSUB2000
  515 FORJ=1TO8
  520 R=8:V=15:GOSUB2000
  530 R=0:V=55:GOSUB2000
  535 REM TURN PHASERS ON
  540 FORI=1TO110:NEXT
  545 REM TURN PHASERS OFF
  550 R=8:V=0:GOSUB2000
  560 FORI=1TO10:NEXT
  570 NEXTJ
  575 REM RANDOMLY GET TO EXPLOSION
  580 IF 3*RND(1)>=2THEN 300
  599 GOTO20
  999 REM CLEAR PSG REGISTERS
 1000 V=0
 1010 FOR R=0TO15
 1020 GOSUB2000
 1030 NEXT
 1040 RETURN
 1999 REM WRITE TO PSG
 2000 POKE80,R:POKE81,V:SYS(876):RETURN
 2499 REM READ FROM PSG
 2500 POKE80,R:SYS(869):RETURN
 2999 REM POKE PSG DRIVER INTO MEMORY
 3000 FOR I=0TO56
 3010 READ A
 3020 POKE 826+I,A
 3030 NEXT
 3040 DATA 165,81,162,2,208,9,165,80,162,255,142,67
 3050 DATA 232,162,3,141,79,232,142,34,232,208,14,162
 3060 DATA0,142,67,232,232,142,34,232,173,79,232,133
 3070 DATA 81,162,0,142,34,232,96,32,64,3,32,81
 3080 DATA3,96,32,64,3,32,58,3,96
 3090 GOTO20
READY.
```

register number in 80 and execute SYS (869). You can get the resulting value by peeking 81. The software is set up to do repeated reads or writes on the same register without having to set the register number up. Execute SYS (826) for writes and SYS (849) for reads.

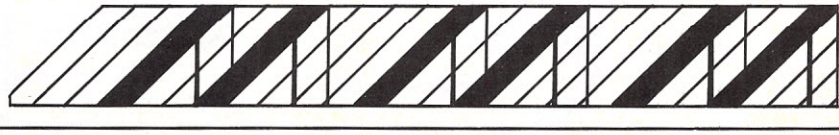
The I/O locations on the PET are $E822(59426), which is the IEEE output port and controls the PSG; $E84F (59471), which is the user port and transfers the data; and $E843(59459), which is the data direction register for the user port that determines the direction of data flow.

Program Updates

Many fine programs have been published in the pages of *Kilobaud Microcomputing*, but they are of little use to you if they aren't compatible with your system. Have you converted any of our programs for use on your own system?

If so, readers are asked to send in program changes they find necessary when they convert a program we have published to another system.

If you have successfully converted a program published in *Microcomputing* for use on your system, send in a printout and a cassette or disk copy of the conversion. We'll check out the conversions and changes to see that they run OK and prepare the converted program for possible publication. This way, you'll be sharing your efforts with thousands of other users, who'll be able to add another selection to their program libraries. Of course, you will be rewarded handsomely for your efforts.



Listing 2 demonstrates the versatility of the PSG and shows how typical sounds are programmed. Lines 3000–3099 POKE the machine-language driver shown in Listing 1 into the second cassette buffer. The subroutine starting at line 1000 clears the PSG registers. The subroutine at line 2000 interfaces BASIC to the PSG driver when writing to it; likewise, subroutine 2500 interfaces when reading from the driver.

Lines 100–199 alternate high and low tones like a European siren. The program enables the low tone for an additional 350 ms, after enabling the high tone on channel A and waiting 350 ms. This repeats until interrupted by the keyboard.

Lines 200–299 perform the whistling bomb noise with a frequency sweep from high to low on channel A. You do this by writing a new value out to R0 of the PSG every few ms. This leads to the bomb-explosion effect in lines 300–399. Here, all tones are shut off, and noise is selected on all three channels. The amplitude is under control of the envelope generator, which starts out at maximum value and decays to zero.

Lines 400–499 produce the wolf whistle. The computer uses both tones to provide the whistle and noise to add breath. It does two frequency sweeps.

Last, lines 500–599 produce phaser fire sounds. These also use noise and tone, except the sound is turned on and off rapidly.

There are ways to improve the efficiency of this chip, particularly in real-time interactive games. All of my demonstration software uses timing loops to generate various sounds. This wastes much time; it would be far better to drive the PSG under interrupt, so that only microseconds need be used.

Remember, once the PSG is set up, it requires no more attention to keep producing that particular sound. Also, at a PSG interrupt, if you use the I/O ports you can read the status of joysticks and other input. You could place the resulting data directly into the memory location, where it is used by BASIC.

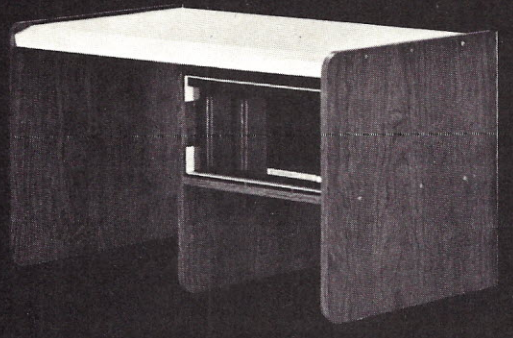
Fortunately, generating interrupts in the PET is easy. You can use the 60 Hz interrupt already in the PET or program the timers in the 6522 VIA (versatile interface adapter) to get interrupts of some other time than 16.67 ms. See the PET manual for further details.■

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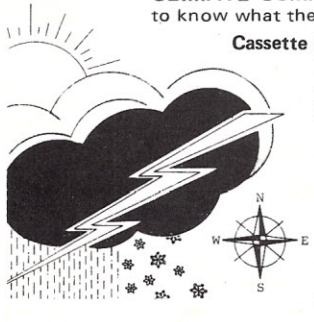
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This PET package lets you keep tabs on your program collection.

Find That Program!

By Robert W. Baker

Program Finder is a two-program package for the PET designed to provide an easy method of locating specific programs or groups of programs within a large program library. One program, Program Data, is used to specify the program categories and qualifiers to be used to identify or separate programs within the collection.

The program categories would normally be used to group programs by type, such as games, business, utility or household. The qualifiers could be anything desired to further separate or classify programs. They would normally be used to identify program requirements, such as needs a printer, uses data files, uses joysticks, written in machine language, uses two tape drives or requires disks.

The program then stores detailed information on each program to be entered in the directory, creating a data file on tape. It has options that allow copying or editing the data files if a second tape is available. This program is extremely flexible and should handle most applications.

The second program, Program Search, will then read the data file created by the other program and display or list the desired information. This program has various options to allow finding groups of programs, such as all game programs, all programs that require a printer or all programs written by a specific author. Other options allow displaying or printing only that information desired for each file that meets the selection criteria.

This program package should provide an easy means of maintaining a large program library without forgetting what programs are available or where they are located. It should also be useful for schools, clubs or other groups sharing a collection of programs. A little experimentation should clearly show how they operate and can best be used for your particular application.

Both programs were written to run on all current model 40-column PETs with any ROM operating system. This includes both ROMs on the 8K PET and the 16/32K PET/CBMs.

Program Search was written to support both the Commodore 2022 and 2023 printers, as well as the Axiom EX-801P printer.

Program Data listing.

```
10 REM ******************************
20 REM
30 REM          PROGRAM DATA
40 REM            FOR TAPE
50 REM
60 REM BY: ROBERT W. BAKER, ATCO, NJ
70 REM
80 REM ******************************
90 :
100 NR=PEEK(50003) :POKE 59468,12
110 CM=14 :QM=14 :DIM C$(CM),Q$(QM) :T$="##EOT%" :FB$="TAPE/DISK ID" :NP=0
120 PRINT"■";TAB(8);"P R O G R A M   D A T A" :PRINT TAB(6); :GOSUB 1310
130 PRINT :PRINT :PRINT"1 - ■CREATE■ NEW PROGRAM FILE DIRECTORY
140 PRINT :PRINT :PRINT"2 -   ■COPY■ OLD PROGRAM FILE DIRECTORY
150 PRINT SPC(11);"WITH OPTION TO ADD ENTRIES" :PRINT
160 PRINT SPC(11);"* REQUIRES 2 TAPE DRIVES *" :PRINT :PRINT
170 PRINT"3 -   ■EDIT■ OLD PROGRAM FILE DIRECTORY" :PRINT
180 PRINT SPC(11);"* REQUIRES 2 TAPE DRIVES *" :PRINT :PRINT
190 GOSUB 1510
200 PRINT"SELECT MODE (1-3): ";
210 GET R$ :IF R$<"1" OR R$>"3" THEN 210
220 PM=VAL(R$) :PRINT"■";
230 IF PM=3 THEN R$="2":PRINT"INSERT TAPE TO BE EDITED IN DRIVE #1," :PRINT
240 IF PM=2 THEN PRINT"INSERT TAPE TO BE COPIED IN DRIVE #1," :PRINT
250 PRINT"INSERT A BLANK TAPE IN DRIVE #";R$;" AND
260 PRINT :PRINT"DEPRESS ANY KEY WHEN READY TO START....
270 GET R$ :IF R$="" THEN 270
280 MC=59411 :MO=53 :MF=61 :FO=122
290 IF PM>1 THEN MC=59456 :MO=207 :MF=223 :FO=58 :GOTO420
300 C=0 :PRINT"■DEFINE PROGRAM CATAGORIES,";CM;"MAX:" :PRINT
310 INPUT"   ■■■■";C$ :IF C$="■" THEN 350
320 C$(C)=C$ :C=C+1 :IF C<CM THEN 310
330 PRINT :PRINT :PRINT"■MAXIMUM NUMBER OF CATAGORIES!" :PRINT
340 PRINT :PRINT"WANT TO RE-ENTER CATAGORIES"; :GOSUB 1520 :IF R$="Y" THEN 300
350 Q=0 :PRINT"■DEFINE PROGRAM QUALIFIERS,";QM;"MAX:" :PRINT
360 INPUT"   ■■■■";Q$ :IF Q$="■" THEN 400
370 Q$(Q)=Q$ :Q=Q+1 :IF Q<QM THEN 360
380 PRINT :PRINT :PRINT"■MAXIMUM NUMBER OF QUALIFIERS!
390 PRINT :PRINT"WANT TO RE-ENTER QUALIFIERS"; :GOSUB 1520 :IF R$="Y" THEN 350
400 INPUT"■DIRECTORY HEADING   ■■■■";H$ :IF H$="■" THEN H$=" "
410 GOTO 510
420 PRINT"■"; :OPEN 1,1,0 :GOSUB 1470 :H$=L$
430 PRINT :GOSUB 1510 :PRINT"DIRECTORY HEADING: ";H$
440 PRINT :GOSUB 1310 :PRINT :PRINT"CORRECT DIRECTORY"; :GOSUB 1520
450 IF R$="N" THEN CLOSE 1:GOTO 120
460 PRINT :PRINT :GOSUB 1510
470 GOSUB 1470 :C=VAL(L$)
480 IF C>0 THEN FOR X=0 TO C-1 :GOSUB 1470 :C$(X)=L$ :NEXT
490 GOSUB 1470 :Q=VAL(L$)
500 IF Q>0 THEN FOR X=0 TO Q-1 :GOSUB 1470 :Q$(X)=L$ :NEXT
510 L=INT((PM+2)/2) :IF NR=0 THEN POKE 243,FO :POKE 244,L+1 :REM OLD 8K TAPE
520 OPEN 2,L,1,H$ :L$=H$ :GOSUB 1430
530 L$=STR$(C) :GOSUB 1430
540 IF C>0 THEN FOR X=0 TO C-1 :L$=C$(X) :GOSUB 1430 :NEXT
```

More →

Program Data

This program will create a tape data file that can be scanned or searched by the Program Search program. If two tapes are available, it will allow copying or editing of pro-

Robert W. Baker (15 Windsor Drive, Atco, NJ 08004) writes the monthly "PET-pourri" column for Microcomputing *magazine.*

gram directories for easy maintenance and updating when required.

When the program is run, select the desired mode by entering the appropriate number from 1 to 3; any other character will be ignored. Insert the appropriate tape(s) and follow the displayed instructions to start.

The *Create mode* creates a new program directory data file. First define the desired program categories, up to 14, and press return. No entries are required if desired. If you should reach the maximum number of entries allowed, you will be given the option of reentering the categories. Some possible suggestions: business, educational, games, household, utilities, graphic/sound demo, miscellaneous and subroutines.

Next, define the desired program qualifiers, again with up to 14 allowed. They are entered in the same way the categories were entered. Some possible suggestions here might be: printer, sound, two-tapes, disk, data files, joysticks, light pen and machine language.

Enter a directory heading to identify this particular directory. This can be useful where multiple directory files are used to further separate an extremely large program collection. You might want separate directories for games, business, etc., and then use the categories to identify board games, card games, strategy games, etc. The directory heading will then identify the specific directory being created or searched.

Once the initial overall data for the directory is defined, you then enter the specific data for each program as follows:

PROGRAM TITLE—The file name used to save the program, 16 characters maximum.

SOURCE/AUTHOR—Who wrote the program or where it was obtained. Defaults to "?" if nothing is entered before hitting return.

PROGRAM SIZE—Approximately how big the program is, or how much memory is required to run the program. Defaults to "?" if nothing is entered before hitting return.

TAPE/DISK ID—Where the program is located, assuming you have devised some kind of tape/disk identification system. This field identifier can be changed by changing the value of FB$ near the beginning of each program. You may want to define this as a backup tape ID, etc.

Program listing continued.

```
550 L$=STR$(Q) :GOSUB 1430
560 IF Q>0 THEN FOR X=0 TO Q-1 :L$=Q$(X) :GOSUB 1430 :NEXT
570 IF PM>1 THEN 940
580 INPUT"□PROGRAM TITLE   ■■■■";PT$ :IF PT$="■" THEN PRINT"□"; :GOTO 980
590 IF LEN(PT$)>16 THEN PRINT"■TOO LONG! (16 CHRS MAX)" :GOSUB 1560:GOTO 580
600 PRINT :INPUT"SOURCE/AUTHOR   ?■■■■";PA$
610 PRINT :INPUT"APPROX. PROGAM SIZE   ?■■■■";PS$
620 PRINT :PRINT FB$;"   ?■■■■"; :INPUT PB$
630 GOSUB 660 :GOSUB 730 :GOSUB 800
640 GOSUB 1280 :PRINT"CORRECT"; :GOSUB 1520 :IF R$="Y" THEN GOSUB 1400
650 GOTO 580
660 PC=0 :IF C=0 THEN RETURN
670 PRINT"□SELECT APPROPRIATE CATAGORIES:" :PRINT
680 FOR X=0 TO C-1 :GOSUB 1500 :PRINT C$(X) :NEXT
690 PRINT :INPUT"ENTER ALL CODE LETTERS   ■■■■";L$ :IF L$="■" THEN RETURN
700 FOR X=1 TO LEN(L$) :L=ASC(MID$(L$,X,1))-65
710 IF L<0 OR L>=C THEN GOSUB 1550 :GOTO 660
720 PC=PC OR (2↑L) :NEXT :RETURN
730 PQ=0 :IF Q=0 THEN RETURN
740 PRINT"□SELECT APPROPRIATE QUALIFIERS:" :PRINT
750 FOR X=0 TO Q-1 :GOSUB 1500 :PRINT Q$(X) :NEXT
760 PRINT :INPUT"ENTER ALL CODE LETTERS   ■■■■";L$ :IF L$="■" THEN RETURN
770 FOR X=1 TO LEN(L$) :L=ASC(MID$(L$,X,1))-65
780 IF L<0 OR L>=Q THEN GOSUB 1550 :GOTO 730
790 PQ=PQ OR (2↑L) :NEXT :RETURN
800 PRINT"□ENTER A BRIEF PROGRAM DESCRIPTION" :PRINT SPC(8);"————
810 PRINT"PRESS CLEAR/HOME WHEN DONE:" :PRINT :GOSUB 1510 :X=0 :PD$=""
820 GET R$ :IF R$="" THEN 820
830 R=ASC(R$) :IF R=13 THEN 850
840 IF (R AND 127)<32 THEN 870
850 PD$=PD$+R$ :PRINT R$; :X=X+1 :IF X<250 THEN 820
860 PRINT"■■■DESCRIPTION TOO LONG!" :GOSUB 1560 :GOTO 800
870 IF R<>20 THEN 920
880 IF X<2 THEN 800
890 X=X-1 :R$=RIGHT$(PD$,1) :PD$=LEFT$(PD$,X)
900 IF ASC(R$)=13 THEN PRINT"■■■■■■" :PRINT PD$; :GOTO 820
910 PRINT CHR$(20); :GOTO 820
920 IF (R AND 127)<>19 THEN 820
930 PD$=PD$+CHR$(19) :RETURN
940 PRINT"□"; :IF PM=2 THEN PRINT"COPYING OLD PROGRAM FILE DIRECTORY....■
950 GOSUB 1470 :IF L$<>T$ THEN 1000
960 PRINT"□■END OF TAPE
970 PRINT :PRINT"WANT TO ADD ENTRIES"; :GOSUB 1520 :IF R$="Y" THEN 580
980 PRINT :L$=T$ :GOSUB 1430 :CLOSE 1:CLOSE 2
990 PRINT :PRINT :PRINT NP;"PROGRAMS IN DIRECTORY" :PRINT :PRINT :END
1000 PT$=L$ :GOSUB 1470 :PA$=L$ :GOSUB 1470
1010 PS$=L$ :GOSUB 1470 :PB$=L$ :GOSUB 1470
1020 PC=VAL(L$) :GOSUB 1470 :PQ=VAL(L$) :PD$=""
1030 GOSU B9100 :PD$=PD$+L$ :IF ASC(L$)<>19 THEN 1030
1040 GOSUB 1460 :IF PM=2 THEN 1260
1050 GOSUB 1280 :PRINT"COPY (C), DELETE (D), OR EDIT (E): ";
1060 GET R$ :IF R$<"C" OR R$>"E" THEN 1060
1070 PRINT"■";R$;
1080 IF R$="C" THEN 1260
1090 IF R$="D" THEN 950
1100 PRINT"□TYPE NEW ENTRY AND ■RETURN■ OR ONLY
1110 PRINT :PRINT"■RETURN■ TO KEEP THE SAME DATA." :PRINT
1120 GOSUB 1510
1130 PRINT"PROGRAM TITLE: ";PT$ :GOSUB 1270 :IF L$<>"■" THEN PT$=L$
1140 PRINT :PRINT"SOURCE/AUTHOR: ";PA$ :GOSUB 1270 :IF L$<>"■" THEN PA$=L$
1150 PRINT :PRINT"SIZE: ";PS$ :GOSUB 1270 :IF L$<>"■" THEN PS$=L$
1160 PRINT :PRINT FB$;": ";PB$ :GOSUB 1270 :IF L$<>"■" THEN PB$=L$
1170 PRINT"□"; :GOSUB 1320
1180 PRINT :PRINT :PRINT"NEW CATAGORIES"; :GOSUB 1520 :IF R$="N" THEN 1200
1190 GOSUB 660
1200 PRINT"□"; :GOSUB 1360
1210 PRINT :PRINT :PRINT"NEW QUALIFIERS"; :GOSUB 1520 :IF R$="N" THEN 1230
1220 GOSUB 730
1230 PRINT"□DESCRIPTION:" :PRINT :PRINT :GOSUB 1300
1240 PRINT"NEW DESCRIPTION"; :GOSUB 1520 :IF R$="N" THEN 1050
1250 GOSUB 800 :GOTO 1050
1260 GOSUB 1400 :GOTO 950
1270 INPUT"■NEW DATA   ■■■■";L$ :RETURN
1280 PRINT"□PROGRAM TITLE: ";PT$ :PRINT"SOURCE/AUTHOR: ";PA$
1290 PRINT"SIZE: ";PS$;"   ";FB$;": ";PB$ :GOSUB 1320 :GOSUB 1360
1300 GOSUB 1310 :PRINT PD$ :PRINT"■■■■■■■■■■■■■■■■■■■■■■" :REM DOWN 21
1310 PRINT"————————————————————" :RETURN
1320 IF PC=0 THEN RETURN
1330 PRINT"CATAGORIES:" :FOR X=0 TO C-1
1340 IF PC AND (2↑X) THEN GOSUB 1500 :PRINT C$(X)
1350 NEXT :RETURN
1360 IF PQ=0 THEN RETURN
1370 PRINT"QUALIFIERS:" :FOR X=0 TO Q-1
1380 IF PQ AND (2↑X) THEN GOSUB 1500 :PRINT Q$(X)
1390 NEXT :RETURN
1400 L$=PT$ :GOSUB 1430 :L$=PA$ :GOSUB 1430:
1410 L$=PS$ :GOSUB 1430 :L$=PB$ :GOSUB 1430
1420 L$=STR$(PC) :GOSUB 1430 :L$=STR$(PQ) :GOSUB 1430 :L$=PD$ :NP=NP+1
1430 Z=TI :PRINT#2,L$ :IF TI-Z<10 THEN RETURN
1440 IF NR THEN POKE MC,MO :FOR Z=1 TO 70 :NEXT :POKE MC,MF
1450 RETURN
1460 GET#1,L$ :GOTO 1480
1470 INPUT#1,L$
1480 IF ST=0 THEN RETURN
1490 PRINT"□TAPE READ ERROR, ST =";ST :CLOSE 1 :CLOSE 2 :END
1500 PRINT SPC(5);CHR$(X+65);" - "; :RETURN
1510 PRINT"————————————————————" :RETURN
1520 PRINT" (Y/N): ";
1530 GET R$ :IF R$="Y" OR R$="N" THEN]PRINT"■";R$;"■"; :RETURN
1540 GOTO 1530
1550 PRINT"■INVALID CODE!
1560 FOR X=1 TO1000 :NEXT :RETURN
READY.
```

DESCRIPTION—A brief description of any miscellaneous information about the program. Up to 250 characters may be entered on multiple lines (using return to end each line), and any characters, as well as graphics, can be included. The CLR/HOME key is used to indicate the end of the description. The default is no description if nothing is entered before hitting return.

The program also requests the appropriate category and qualifier code. This code is a string of letters identifying the desired categories/qualifiers to be associated with the program and can be any combination from the list of available categories/qualifiers.

After all data for a program is entered, the entire entry will be displayed in the normal display format and you are asked if it is correct. If not, you can discard the current values and reenter the entire entry again. Typing return with no data specified for source/author, size or ID will enter a "?" in that field as a default value. Hitting CLR/HOME before any description is entered will give a blank description.

Hit return without entering any program title to indicate all programs have been entered into the directory. This will close the output file and terminate the program. The display will indicate the number of programs entered into the directory.

One additional note on entering the description. The delete key will still operate as usual and will delete the last character entered (including returns). All other cursor control characters will have no effect.

The *Copy mode* requires a second tape drive and is used to copy the entire contents of an existing program directory unchanged. It does allow adding new programs at the end of the directory if desired. Additional entries are entered as described for the Create mode.

The *Edit mode* also requires a second tape drive and is used to selectively copy the contents of an existing program directory. Each entry is displayed and can be copied (unchanged), deleted or edited. When an entry is edited, you have the option of changing each individual field of data for that program. After checking all fields, the updated data is displayed and you can copy, delete or edit it again. After the entire existing program directory has been read, you have an option to add additional new entries. The instructions displayed during the editing should be sufficient to understand the operation and achieve the desired results.

Program Search

This program reads the program directory data files created by Program Data and selectively displays data about the programs. The best way to understand the many options and features of this program is to first create a simple directory and then play with this program, trying the various options.

When run, the program first opens the file and checks if this is the desired program directory. If correct, the program categories and qualifiers are read from the file and saved before asking what to search for. The first question asks if a complete list of all programs is desired. If the answer is "N" (no), you can then enter the desired selection criteria to be searched on: program title, source/author or tape/disk ID. Hitting return with no data specified will allow any value for that field to be a match.

If any data is entered, it will be compared with the corresponding field for each entry in the directory. Only the number of characters entered for each field are compared and considered a match if equal. This is similar in operation to what happens when you enter LOAD XYZ to the PET Operating System, where it will match on XYZABC. Thus, if you enter a selection program title of "time", all titles starting with "time" will be

```
PROGRAM TITLE: PROGRAM DATA
SOURCE/AUTHOR: ROBERT BAKER
SIZE: 8K   TAPE/DISK ID: 30
CATAGORIES:
     C - UTILITY
QUALIFIERS:
     A - NEEDS 2 TAPES
     B - USES DISK FILES
     C - PRINTER
-------------------------------
THIS PROGRAM CREATES THE DATA FILES
USED BY PROGRAM SEARCH TO ALLOW FINDING
GROUPS OF PROGRAMS WITH COMMON
FUNCIONS, NEEDS, ETC.

*******************************


PROGRAM TITLE: PROGRAM SEARCH
SOURCE/AUTHOR: ROBERT BAKER
SIZE: 8K   TAPE/DISK ID: 30
CATAGORIES:
     C - UTILITY
QUALIFIERS:
     A - NEEDS 2 TAPES
     B - USES DISK FILES
     C - PRINTER
-------------------------------
THIS PROGRAM READS THE DATA FILES
CREATED BY 'PROGRAM DATA'

IT ALLOWS FINDING GROUPS OF PROGRAMS
WITH SIMILAR ATTRIBUTES...

THUS, YOU COULD EASILY GET A LIST OF
ALL GAME PROGRAMS WRITTEN BY A SPECIFIC
AUTHOR THAT HAVE SOUND AND USE
JOYSTICKS!

*******************************

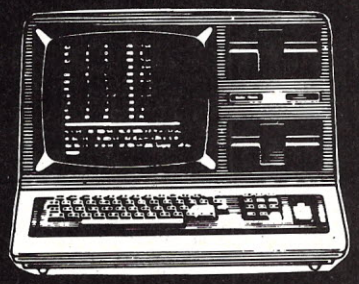

 2 PROGRAMS FOUND IN DIRECTORY
```

Typical printouts of directory data.

Program Search listing.

```
10 REM ******************************
20 REM
30 REM          PROGRAM SEARCH
40 REM             FOR TAPE
50 REM
60 REM BY: ROBERT W. BAKER, ATCO, NJ
70 REM
80 REM ******************************
90 :
100 CM=14 :QM=14 :DIM C$(CM),Q$(QM) :T$="##EOT%"
110 FB$="TAPE/DISK ID" :POKE 59468,12
120 PRINT"■";TAB(6);"P R O G R A M   S E A R C H" :PRINT TAB(6); :GOSUB 1200
130 PRINT :PRINT :PRINT"INSERT TAPE TO BE READ IN DRIVE #1," :PRINT
140 GOSUB 1300 :PRINT :PRINT :NP=0
150 OPEN 1,1,0 :GOSUB 1270 :H$=L$
160 PRINT"■DIRECTORY HEADING: ";H$ :PRINT :GOSUB 1200
170 PRINT :PRINT"CORRECT DIRECTORY";
180 GOSUB 1360 :IF R$="N" THEN CLOSE 1 :GOTO 120
190 PRINT"■■READING DIRECTORY CATAGORIES/QUALIFIERS
200 GOSUB 1270 :C=VAL(L$)
210 IF C>0 THEN FOR X=0 TO C-1 :GOSUB 1270 :C$(X)=L$ :NEXT
220 GOSUB 1270 :Q=VAL(L$)
230 IF Q>0 THEN FOR X=0 TO Q-1 :GOSUB 1270 :Q$(X)=L$ :NEXT
240 PRINT :PRINT :PRINT"OK, READY TO SCAN FOR SELECTED FILES."
250 PRINT :GOSUB1350
260 PRINT :PRINT"COMPLETE LIST OF ALL FILES"; :GOSUB 1360 :IF R$="N" THEN 300
270 PRINT :GOSUB 710 :PRINT"■SEARCHING....." :PRINT :PRINT
280 GOSUB 1210 :IF PT$=T$ THEN 620
290 GOSUB 960 :GOTO 280
300 PRINT"■ENTER SELECTION CRITERIA FOR SELECTED
310 PRINT :PRINT"SCAN. DEPRESS ■RETURN■ AFTER EACH ENTRY.
320 PRINT :PRINT"DEPRESS ■RETURN■ ONLY TO SKIP A GIVEN" :PRINT SPC(15);"——
330 PRINT"ITEM AND ALLOW 'ALL' VALUES FOR THAT
340 PRINT :PRINT"FIELD TO MATCH DURING THE SCAN." :PRINT :GOSUB 1350
350 INPUT"PROGRAM TITLE   ■■■■";CT$ :■F CT$="■" THEN CT$=""
360 IF LEN(CT$)>16 THEN PRINT"■■TOO LONG! (16 CHRS MAX)" :GOSUB 1400 :GOTO 350
370 PRINT :INPUT"SOURCE/AUTHOR   ■■■■";CA$ :IF CA$="■" THEN CA$=""
380 PRINT :PRINT FB$;"   ■■■■"; :INPUT CB$ :IF CB$="■" THEN CB$=""
```

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indicated: time billing, time clock, timer, etc. You can also select the desired categories and/or qualifiers to be scanned for, in any combination. To be considered a match, and be displayed/printed, the title, author and ID must be equal and the program must have one of the categories and/or qualifiers specified.

Once the selection criteria are specified, you can have the data found on each program printed on a printer or displayed on the display. Furthermore, you can limit the amount of data to be shown by specifying only those fields wanted, or what fields to delete from the full format. After scanning an entire directory, the number of programs found matching the selection criteria will be indicated and you can scan another directory.

If you have a Commodore 2040 disk, I have another set of programs that use sequential disk data files instead of using tape. The disk version makes the editing capabilities more useful. If anyone is interested, I'll provide a copy of either set of programs on cassette tape for $2 to cover costs. Indicate which you prefer.■

Program listing continued.

```
390 CC=2↑CM-1 :IF C=0 THEN 460
400 PRINT"□SELECT APPROPRIATE CATAGORIES:" :PRINT
410 FOR X=0 TO C-1 :GOSUB 1330 :PRINT C$(X) :NEXT
420 PRINT :INPUT"ENTER ALL CODE LETTERS   ▄▀▀▀";L$ :IF L$="▄" THEN 460
430 CC=0 :FOR X=1 TO LEN(L$) :L=ASC(MID$(L$,X,1))-65
440 IF L<0 OR L>=C THEN GOSUB 1390 :GOTO 390
450 CC=CC OR (2↑L) :NEXT
460 CQ=2↑QM-1 :IF Q=0 THEN 530
470 PRINT"□SELECT APPROPRIATE QUALIFIERS:" :PRINT
480 FOR X=0 TO Q-1 :GOSUB 1330 :PRINT Q$(X) :NEXT
490 PRINT :INPUT"ENTER ALL CODE LETTERS   ▄▀▀▀";L$ :IF L$="▄" THEN 530
500 CQ=0 :FOR X=1 TO LEN(L$) :L=ASC(MID$(L$,X,1))-65
510 IF L<0 OR L>=Q THEN GOSUB 1390 :GOTO 460
520 CQ=CQ OR (2↑L) :NEXT
530 PRINT"□"; :GOSUB 710
540 PRINT"□SEARCHING....." :PRINT :PRINT
550 GOSUB 1210 :IF PT$=T$ THEN 620
560 IF (CC AND PC)=0 THEN 550
570 IF (CQ AND PQ)=0 THEN 550
580 IF CT$<>MID$(PT$,1,LEN(CT$)) THEN 550
590 IF CA$<>MID$(PA$,1,LEN(CA$)) THEN 550
600 IF CB$<>MID$(PB$,1,LEN(CB$)) THEN 550
610 GOSUB 960 :GOTO 550
620 IF (PF>0) AND (FF=0) THEN FOR X=1 TO 3 :PRINT#4 :NEXT
630 IF PF THEN PRINT#4,NP;"PROGRAMS FOUND IN DIRECTORY":FOR X=1TO6:PRINT#4:NEXT
640 CLOSE 1 :CLOSE 4
650 IF PF+FF=0 THEN PRINT :GOSUB 1200 :GOSUB 1300
660 PRINT"□□END OF TAPE" :PRINT
670 PRINT NP;"PROGRAMS FOUND IN DIRECTORY" :PRINT :PRINT
680 PRINT"SEARCH ANOTHER DIRECTORY";
690 GOSUB 1360 :IF R$="Y" THEN PRINT :GOTO 120
700 PRINT :PRINT :END
710 FF=2↑6-1 :PF=0 :PRINT :PRINT :PRINT"PRINTED LIST (P) OR DISPLAY (D): ";
720 GET R$ :IF R$="D" THEN OPEN 4,3 :GOTO 750
730 IF R$<>"P" THEN 720
740 PF=1 :OPEN 4,4 :PRINT#4,CHR$(8);
750 PRINT"#";R$
760 PRINT"□□COMPLETE DATA ON ALL FILES"; :GOSUB 1360 :IF R$="Y" THEN RETURN
770 PRINT"□SELECT CODE LETTERS FOR ALL FIELDS TO
780 PRINT :PRINT"BE DISPLAYED, OR FIELDS TO BE OMITTED
790 PRINT :PRINT"IF PRECEDED BY A MINUS SIGN '-'" :PRINT :PRINT
800 GOSUB 1350
810 PRINT SPC(7);"- PROGRAM TITLE (MINIMUM)
820 PRINT SPC(5);"A - SOURCE/AUTHOR
830 PRINT SPC(5);"B - SIZE
840 PRINT SPC(5);"C - ";FB$
850 PRINT SPC(5);"D - CATAGORIES
860 PRINT SPC(5);"E - QUALIFIERS
870 PRINT SPC(5);"F - DESCRIPTION" :PRINT :PRINT :PRINT
880 INPUT"□ENTER ALL CODE LETTERS   ▄▀▀▀";L$ :IF L$="▄" THEN FF=0 :RETURN
890 Y=0 :Z=1 :IF LEFT$(L$,1)="-" THEN Z=2
900 IF LEN(L$)<2 THEN GOSUB 1390 :GOTO 770
910 FOR X=Z TO LEN(L$) :L=ASC(MID$(L$,X,1))-65
920 IF L<0 OR L>5 THEN GOSUB 1390 :GOTO 770
930 Y=Y OR (2↑L) :NEXT
940 FF=Y :IF Z=2 THEN FF=2↑6-1-Y
950 RETURN
960 NP=NP+1 :IF FF>0 THEN PRINT#4,"□";
970 PRINT#4,"PROGRAM TITLE: ";PT$
980 IF (FF AND 1) THEN PRINT#4,"SOURCE/AUTHOR: ";PA$
990 IF (FF AND 2) THEN PRINT#4,"SIZE: ";PS$;SPC(3);
1000 IF (FF AND 4) THEN PRINT#4,FB$;": ";PB$;
1010 IF (FF AND 6) THEN PRINT#4
1020 IF (PC=0) OR ((FF AND 8)=0) THEN 1060
1030 PRINT#4,"CATAGORIES:" :FOR X=0 TO C-1
1040 IF PC AND (2↑X) THEN GOSUB 1340 :PRINT#4,C$(X)
1050 NEXT
1060 IF (PQ=0) OR ((FF AND 16)=0) THEN 1100
1070 PRINT#4,"QUALIFIERS:" :FOR X=0 TO Q-1
1080 IF PQ AND (2↑X) THEN GOSUB 1340 :PRINT#4,Q$(X)
1090 NEXT
1100 IF (FF AND 32)=0 OR LEN(PD$)=0 THEN 1160
1110 PRINT#4,"──────────"
1120 FOR X=1 TO LEN(PD$) :L$=MID$(PD$,X,1)
1130 IF ASC(L$)<>13 THEN PRINT#4,L$; :GOTO 1150
1140 PRINT#4
1150 NEXT :PRINT#4
1160 IF (PF=0) OR (FF=0) THEN 1180
1170 PRINT#4,"▒▒▒
```

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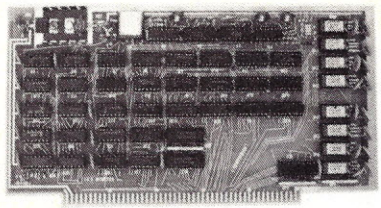
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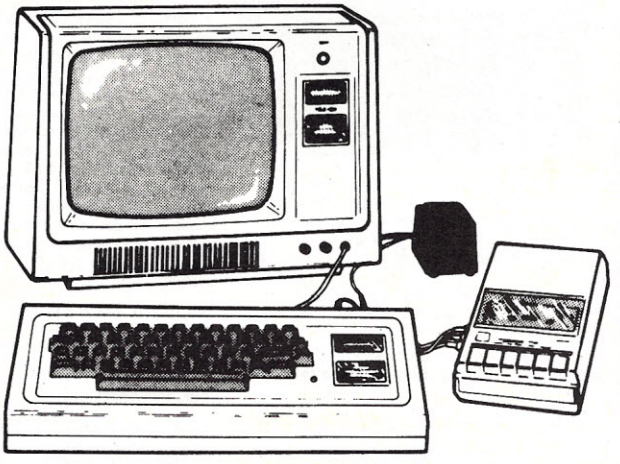
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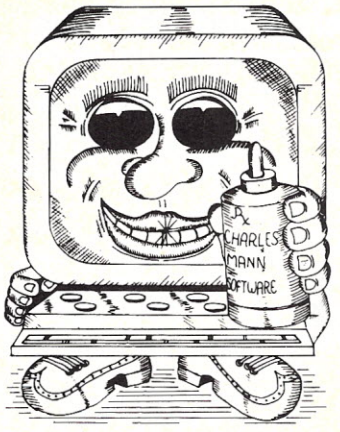
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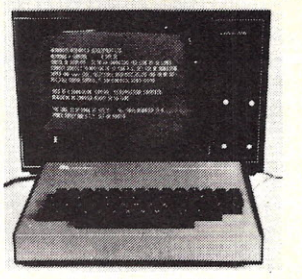
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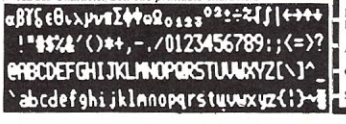
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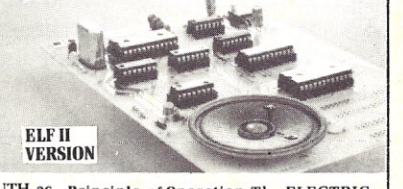
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ELEVEN	AT	GALLON	MINUS	SPEED
TWELVE	CANCEL	GO	MINUTE	STAR
THIRTEEN	CASE	GRAM	NEAR	START
FOURTEEN	CENT	GREAT	NUMBER	STOP
FIFTEEN	400HERTZTONE	GREATER	OF	THAN
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For dial-up ability, all you need is a telephone, modem, C1P and this hardware/software design.

Not-So-Dumb Dumb Terminal

By James C. Daly

The Ohio Scientific C1P computer can be used as a dumb terminal for transmitting and receiving data. This lets you communicate with distant computers and take advantage of a variety of dial-up services. The software occupies only 60 bytes of memory and can be read into memory from a 20 line BASIC program.

The simplicity is achieved by using two BASIC service subroutines located in C1P's ROM. The subroutine located at $FFEB (the dollar sign indicates a hex number) polls the keyboard and stores the ASCII character representing the key closed in the MPU accumulator. A second BASIC service subroutine located at $FFEE displays the character stored in the MPU accumulator on the screen in the proper location. When the terminal program is running, the display behaves as it does in the BASIC mode with lines written near the bottom of the screen and scrolled up as more characters are displayed.

The program consists of two parts. The first, MAIN, gets characters from the keyboard, transmits them and displays them on the screen. The BASIC service subroutine in ROM, used to read the keyboard, waits for a key closure. This requires that incoming data interrupt the MPU to respond, read and display the incoming data. Therefore, the second part of the program consists of an interrupt service routine to receive data and display it on the screen.

The BASIC program shown reads and stores the machine-language program and writes the following instructions on the screen:

```
TERMINAL PROGRAM
When I say OK
hit BREAK and
type M.0900G
OK
```

The OK indicates that the BASIC program is completed. Hitting BREAK and typing M.0900G causes the machine-language program MAIN located at $0900 to be executed. C1P now behaves as a dumb terminal.

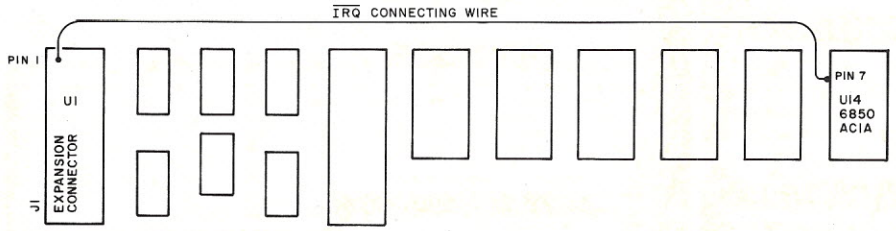


Fig. 1. Wiring modifications required to connect Interrupt line from ACIA to the 6502 MPU.

Control Register Contents (Hex number)	Word Length (Bits)	Parity	Stop Bits
81	7	even	2
85	7	odd	2
89	7	odd	1
8D	7	odd	1
91	8	none	2
95	8	none	1
99	8	even	1
9D	8	odd	1

Table 1. ACIA configuration. These control register values enable receive interrupts and divide the ACIA clock by 16.

Hardware and Software

To operate C1P as a dumb terminal, you need the following hardware:

- an RS-232 output port. The circuit board has provision for this, but the components are not in place when it is sent from the factory. The computer store where I bought my C1P installed the RS-232 port for about $50. The circuit diagram is in the C1P user's manual. Components are added to prepared positions on the circuit.
- a connection of the $\overline{IRQ}$ (interrupt request) pin 7 of the ACIA (asynchronous communications interface adapter, MC6850, chip U14) to the $\overline{IRQ}$ pin of the MPU. This can be done by running a wire from pin one of the J1(U1) expansion port to pin 7 of the ACIA (U14) as shown in Fig. 1. Connection to the J1 expansion port is easy; just push the wire into socket position 1. Connection to the ACIA was done by filing the wire end to a wedge and pushing it down into the socket together with pin 7 of the ACIA chip. A true RS-232 signal represents binary zero with a negative

Address correspondence to J. C. Daly, Department of Electrical Engineering, University of Rhode Island, Kingston, RI 02881.

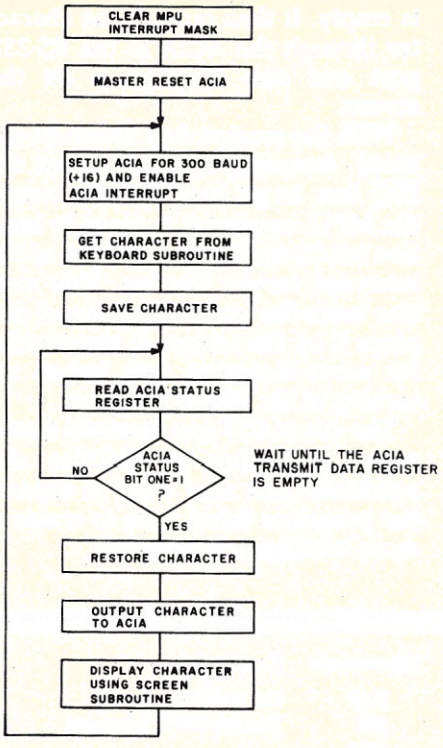


Fig. 2. MAIN program flowchart. This program gets data from the keyboard, displays it on the screen and transmits it to the modem via the ACIA. It is interrupted when data is received.

Location	Hex Code	Decimal Code	Mnemonic	Comments
0900	58	88	CLI	Clear MPU interrupt mask
0901	A9,03	169,3	LDA	
0903	8D,00,F0	141,0,240	STA	Master reset ACIA
0906	A9,81	169,129,	LDA	Set up for 300 baud (÷16) set word length and parity
0908	8D,00,F0	141,0,240	STA	and enable receive interrupt
090B	20,EB,FF	32,235,255	JSR	Get character from keyboard subroutine at FFEB
090E	48	72	PHA	Save character
090F	AD,00,F0	173,0,240	LDA	Read ACIA status
0912	4A	74	LSR	Check bit one of the ACIA status register. If it is clear check it again.
0913	4A	74	LSR	
0914	90,F9	144,249	BCC	
0916	68	104	PLA	Restore character
0917	8D,01,F0	141,1,240	STA	Output character to ACIA
091A	20,EE,FF	32,238,255	JSR	Display character using screen subroutine
091D	4C,06,09	76,6,9	JMP	Go to 0906

MAIN program.

```
 4  FOR N=1 TO 30 : PRINT : NEXT
 5  PRINT "          TERMINAL PROGRAM"
 6  PRINT : PRINT : PRINT : PRINT : PRINT
 7  PRINT "          WHEN I SAY OK,"
 8  PRINT "          HIT BREAK AND"
 9  PRINT "          TYPE M.0900G"
10  PRINT : PRINT : PRINT : PRINT : PRINT
12  FOR N=I TO 57
20  READX : POKE N+2303, X : NEXT
30  FOR N=I TO 3
40  READ X : POKE N+447, X : NEXT

100 DATA 88, 169, 3, 141, 0, 240, 169
110 DATA 129, 141, 0, 240, 32, 235, 255
120 DATA 72, 173, 0, 240, 74, 74, 144
130 DATA 249, 104, 141, 1, 240, 32, 238, 255
140 DATA 76, 6, 9
160 DATA 120, 72, 138, 72, 152, 72
170 DATA 173, 1, 240
180 DATA 32, 238, 255, 173, 0, 240, 74
190 DATA 176, 244
200 DATA 104, 168, 104, 170, 104, 88, 64
210 DATA 76, 32, 9
```

BASIC terminal program.

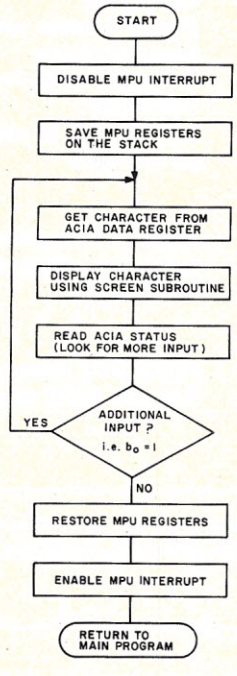


Fig. 3. Flowchart for the Interrupt Service routine, which is executed whenever input data is present. It receives input data from the ACIA and displays it on the screen.

voltage. Since C1P has no negative supply, you may have to supply a negative voltage to pin 7 of the J3 connector as shown in your C1P user's manual. The modem I used recognized zero volts as a binary zero; therefore, no negative voltage was required.

- a modem and, of course, a telephone.

The ACIA chip, U14, interfaces the MPU with the serial RS-232 port. The ACIA occupies two memory locations, $F000 and $F001. Two registers are at each location. Information can be put into the WRITE ONLY control register at $F000 or read from the READ ONLY status register at $F000. Therefore, both the control and status registers appear at $F000. The read/write line determines which is addressed. Similarly, the READ ONLY receive data register and the WRITE ONLY transmit data register appear at $F001, with the read/write line determining which register is addressed.

The program described here writes a hex 81 into the control register (program lines 906 and 908). This enables receive data interrupt, sets up the ACIA for a seven-bit word length,

even parity, with two stop bits, and causes the ACIA clock input frequency of 4726 Hz to be divided by 16. This results in a baud rate of 295.4. This baud rate was close enough to 300 to work with the computer I connected to. Other word lengths, parities and stop bits can be obtained by replacing the 81 hex value with the values given in Table 1.

When operating, the MAIN program first initializes the ACIA and then jumps to the keyboard subroutine at $FFEB in ROM. The MPU spends most of its time here waiting for a key closure. When a key is closed, the ASCII value is pushed onto the stack. The MPU waits again until the ACIA transmit data register is empty. It then outputs the character through the ACIA to the RS-232 port and also displays it on the screen.

With the receive data interrupt enabled, incoming data will cause the $\overline{IRQ}$ line to go low. This interrupts the MPU, causing it to jump to location $01C0 and begin execution of the interrupt service routine. This routine reads the incoming data and displays it on the screen. It also checks for more incoming data before returning to the MAIN program.

The use of C1P as a terminal opens many computing possibilities. An ambitious user may want to expand the programs listed here to create a more intelligent terminal. ■

Location	Hex Code	Decimal Code	Mnemonic	Comments
01C0	4C,20,09	76,32,9	JMP	Go to 0920
0920	78	120	SEI	Disable MPU interrupt
0921	48	72	PHA	
0922	8A	138	TXA	Save MPU registers
0923	48	72	PHA	on the stack
0924	98	152	TYA	
0925	48	72	PHA	
0926	AD,01,F0	173,1,240	LDA	Get character from ACIA data register
0929	20,EF,FF	32,238,255	JSR	Display character using screen subroutine
092C	AD,00,F0	173,0,240	LDA	Read ACIA status (look for more input)
092F	4A	74	LSR	If ACIA status bit zero = 1, get data again
0930	B0,F4	176,244	BCS	
0932	68	104	PLA	
0933	A8	168	TAY	Restore MPU registers by pulling data off the stack
0934	68	104	PLA	
0935	AA	170	TAX	
0936	68	104	PLA	
0937	58	88	CLI	Enable MPU interrupt
0938	40	64	RTI	Return to MAIN program

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Here's a simple do-it-yourself approach using an 1802.

Programming the 2716

By Stephen D. Merrin

The 5-volt 2716 EPROM (Intel version) is becoming more attractive as the price drops. For those experimenters familiar with the RCA 1802 microprocessor, here's a simple approach to programming the 2716. A short program for the 1802 microprocessor controls the programming process by fetching bytes to be programmed and by providing the required 50 ms program pulses.

Suppose the block of data about to be programmed into the 2716 resides in the microprocessor system memory and that the start address of this block is passed to the controlling program in R(6). The number of bytes in the block is passed in R(4).

The capacity of the 2716 is 2048 eight-bit bytes. The 11-bit addresses (terminals A_0, A_1, ... A_{10} on the 2716) can be expressed as three-digit hex values, ranging from 000 to 7FF. Suppose that programming is to start at address XYZ in the 2716. The address 0XYZ is passed to the controlling program in R(7). (The address 0XYZ lies in the range 0000 to 07FF.)

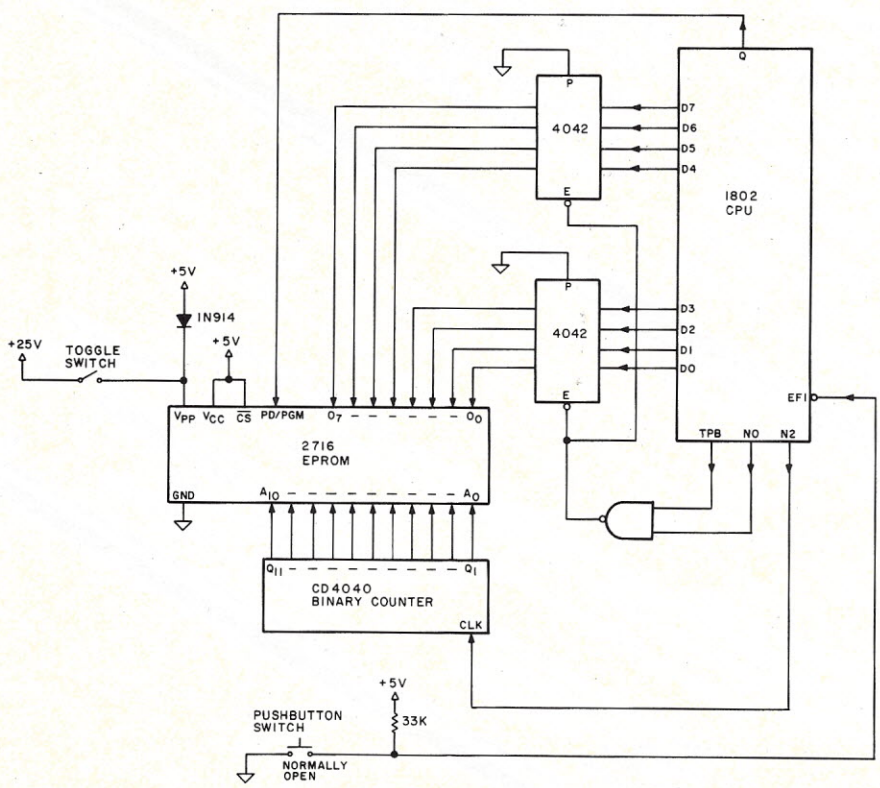


Fig. 1. Programming circuit.

The Circuits

Look at the programming circuits used (Fig. 1). Data bytes about to be programmed are latched into two four-bit registers (CD4042). The microprocessor outputs N0 and TPB are ANDed to provide the latching pulse. An 11-bit binary counter (CD4040), cleared just before executing the controlling program, will provide the 11-bit address to the 2716. This counter is incremented under program control by the microprocessor output N2.

The controlling program will pro-

Address correspondence to Stephen D. Merrin, 4470 NW Alpha Place, Apt. 6, Corvallis, OR 97330.

Clock frequency	V (decimal)	V (hex)
1 MHz	1297	0511
2 MHz	2338	0922
3 MHz	3380	0D34
4 MHz	4422	1146

Table 1.

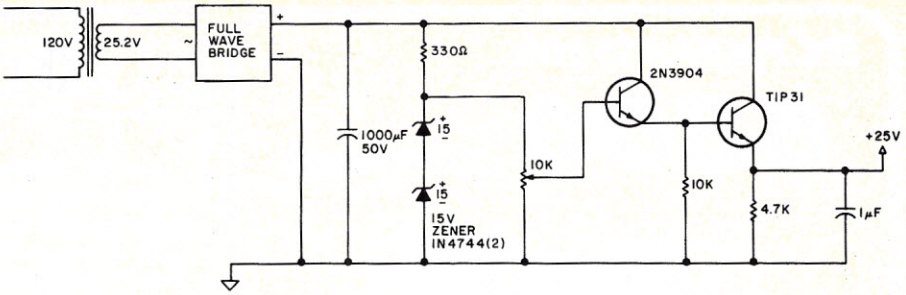


Fig. 2. Source voltage circuit.

vide a 50 ms pulse to the PD/PGM terminal of the 2716, using the Q output of the microprocessor. A toggle switch sets V_{pp} to either +5 V or +25 V (in Fig. 2 is the 25-volt source I use; most or all of the parts I obtained from Radio Shack. The 10k pot is adjusted to give exactly 25 V at the output).

According to Intel's specifications, V_{pp} can be left at +25 V continuously during programming. V_{pp} is switched manually from +5 V to +25 V during a programmed pause provided in the controlling program. The 1802 waits until the EF1 line goes low before continuing; a push-button switch controls the level of EF1. Unless this switch is closed, EF1 remains high. When programming is complete, V_{pp} is set back to +5 V.

To program a byte into the 2716, the Q output of the 1802 is maintained at 1 for 50 ms, while V_{pp} is at +25 V. The controlling program stays in a loop for 50 ms to provide the pulse on the Q line. The loop count required will depend on the microprocessor clock frequency used. We will discuss this point later.

Controlling Program

Prior to calling this routine, as mentioned earlier, R(6) holds the start address of the data block about to be transferred to the 2716, R(4) holds the number of bytes in the block, and R(7) holds the 2716 start address. Clear the 4040 binary counter. V_{pp} should be at +5 V (it will be manually switched to +25 V during the programmed pause, occurring at the line labeled WAIT). When execution begins, the binary counter is incremented from 000 to the required start address XYZ. Each pulse on the N2 line causes the 4040 counter to increment; the register R(0) is only indirectly involved here, but note that it is altered and cannot be used as the program counter.

Next, a pause occurs, during which we can verify the contents of the 4040 counter (assuming LEDs are used to display its contents). Close the toggle switch to set V_{pp} = +25 V and then depress the EF1 push-button switch. Actual programming of the 2716 now takes place. Programming time is one second per 20 bytes programmed; a halt occurs when the IDLE command is reached. At this time, switch V_{pp} back to +5 V.

It remains to discuss how to accomplish the 50 ms delay, during which Q = 1. The three-instruction delay loop (starting with line LOOP in the program) requires 3(V – 255) fetch/execute cycles, where V equals the value initially loaded into R(7) at the line labeled LUP. Since each fetch/execute cycle requires 16T seconds (where T is the clock period), the loop provides a total delay of 48T(V – 255) seconds. We thus choose V so that this last expression will equal 50 ms. Table 1 shows the values for different clock frequencies.

The hex value of V is loaded into R(7), which is loaded using four instructions, starting with line LUP in the program. The program listing shows V appropriate for a 1 MHz clock, which I use in my system.

I have programmed 2716s for both 1802- and Z-80-based systems with complete success using the method described here, adapted to my own home-built 1802 system.■

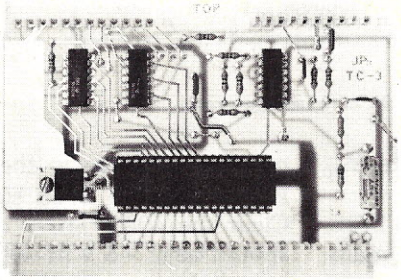
```
op codes        instructions              comments

 7A       PROG: 0→Q
 97             R(7).1→D                  test if 2716
 3A NXT.        If D ≠ 0 go to NXT        start addr
 87             R(7).0→D                  is 000
 32 WAIT.       If D = 0 go to WAIT
 E0       NXT:  0→X
 64       LAP:  M(R(X))→BUS & incr R(X) N=4      increment
 27             decr R(7)                        binary counter
 97             R(7).1→D                         from 000
 3A LAP.        If D ≠ 0 go to LAP               to XYZ
 87             R(7).0→D
 3A LAP.        If D ≠ 0 go to LAP
 3C WAIT. WAIT: If EF1 = 0 go to WAIT     pause to set V_pp=+25v
 F8 05    LUP:  05→D
 B7             D→R(7).1                  load R(7) with delay
 F8 11          11→D                      count to provide 50 ms
 A7             D→R(7).0                  pulse; 0511 is for 1 MHz clock
 E6             6→X
 61             M(R(X))→BUS & incr R(X) N=1      fetch data byte
 C4             NOP                              to be programmed
 7B             1→Q                       start programming pulse
 27       LOOP: decr R(7)                 Q=1 maintained for
 97             R(7).1→D                  50 ms by delay loop
 3A LOOP.       If D ≠ 0 go to LOOP
 7A             0→Q                       end programming pulse
 C4             NOP
 E0             0→X
 64             M(R(X))→BUS & incr R(X) N=4      increment binary
 24             decr R(4)                        counter to next
 94             R(4).1→D                         2716 addr
 3A LUP.        If D ≠ 0 go to LUP        loop back if
 84             R(4).0→D                  more data bytes
 3A LUP.        If D ≠ 0 go to LUP        remain
 00             IDLE          halt; programming complete
                              put V_pp back to +5v
```

Program listing. Programming the 2716 in assembly language.

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CORRECTIONS

Several *Microcomputing* readers have written or called in to report a problem with the 2102 memory wiring configuration as presented in "Reverse Video for the OSI C1P" (January 1981, p. 176). This problem shows up as flickering horizontal lines moving across the display.

The article's author, Donn Burke Baker, reports that "the problem is with the selection of address lines for the added 2102 memory.

"The article shows 2102 address lines coming from the INPUTs of the address/scan multiplexers (U53, U54, U55). These lines should be connected to the OUTPUTs of the same multiplexers. Table 1 shows the 2102 pins, the old multiplexer connections and the new connections on the multiplexers. These changes will correct the problem.

"A point of confusion also exists in the text on page 180 of the article. In the second column, the text says to connect ". . . U55, pin 5, to U28, pin 9." This should read ". . . U28, pin 14." The schematic shown on page 178 has the correct pin numbers. (Note that this is one of the address lines changed above.)"

2102 Pin no.	Old U53,54,55 pins	New U53,54,55 pins
U28-8	U53-2	U53-4
U28-4	U53-5	U53-7
U28-5	U53-11	U53-9
U28-6	U53-14	U53-12
U28-7	U54-2	U54-4
U28-2	U54-5	U54-7
U28-1	U54-11	U54-9
U28-16	U54-14	U54-12
U28-15	U55-2	U55-4
U28-14	U55-5	U55-7

Table 1.

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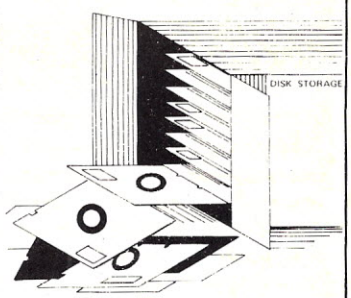
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CALENDAR

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The 1981 International Summer Consumer Electronics Show will be held Sunday, May 31, through Wednesday, June 3, 1981, in Chicago at the McCormick Place/Inn and Pick Congress Hotel. Exhibits will include products such as tape/disk systems, video software, projection TVs, and personal electronics, including computers.

For information contact Consumer Electronics Shows, Two Illinois Center—Suite 1607, 233 N. Michigan Ave., Chicago, IL 60601.

Applefest Comes to Boston

Applefest '81, devoted exclusively to the Apple computers, will take place Saturday and Sunday, June 6 and 7, 1981, at the Plaza Castle, Arlington St., Boston, MA. Over 100 exhibits of Apple computers, software, peripherals, accessories, applications and services will be featured. Free seminars will run the two days of the show. Admission is $3 per day.

Applefest '81 is sponsored by Apple/Boston, the Boston Computer Society's Apple user group. For information or tickets, contact: The Boston Computer Society, Three Center Plaza, Boston, MA 02108. 617-367-8080.

Atlanta Small Computer Show

The Atlanta Small Computer Show will be held June 6–9, 1981, at the Atlanta Hilton. Exhibitors will include producers of small computers, peripheral equipment, supplies and services.

For information, write The Atlanta Small Computer Show, 4060 Janice Drive, Suite C-1, East Point, GA 30344, or call 404-767-9798.

Electronics Workshop

Two workshops are being presented by Virginia Tech in Blacksburg, VA. Digital Electronics for Automation and Instrumentation will be June 22 and 23, 1981. Microcomputer Design Interfacing, Programming and Application using the Z-80/8085/8080 will be June 24–27, 1981.

For more information contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg, VA 24061, 703-961-5241.

National TRS-80 Microcomputer Show

The first annual National TRS-80 Microcomputer Show will be held in New York City on May 22, 23 and 24 at the New York Statler Exposition Center (opposite Madison Square Garden and Pennsylvania Railroad Station). The show will feature commercial exhibits, seminars and speakers. For further information, contact Kengore Corporation, 3001 Route 27, Franklin Park, NJ 08823, 201-297-6918.

Computers in Education

The third annual Computers in Education Conference will be held at Seattle Pacific University, Seattle, WA, on May 1–2. It will feature panel discussions, talks, workshops and exhibits, with a special emphasis on the use of microcomputers in grades K–12. For further information, contact Jerry Johnson, Seattle Pacific University, Seattle, WA 98119.

New York Computer Show

Dates of the fifth Annual National Small Computer Show in the New York Coliseum are Aug. 26–29, 1981. The majority of visitors will be business-oriented buyers. A full schedule of free lectures will be presented daily at the show, and there will be a five-hour seminar daily for executives who wish an overall introduction to business computers.

Registration fee is $10 per day. The seminar for executives has a registration fee of $200 per person, including all materials and show registration.

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Computer Summer Camp

This summer youngsters can again sign up for an overnight camp in Moodus, CT, where the main activity will be computers. This unique recreational and educational experience is directed by Dr. Michael Zabinski, Professor at Fairfield University.

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For information, contact Michael Zabinski at 203-795-9069, or write to Computer Camp, Grand View Lodge, Box 22, Moodus, CT 06469.

Computers and the Humanities

The University of Michigan will host the fifth International Conference on Computers and the Humanities (ICCH/5) on May 17–20 and the Joint Conference on Easier and More Productive Use of Computing Systems on May 20–22. For further information, contact Ida M. Sanburn, 4258 Institute for Social Research, University of Michigan, Ann Arbor, MI 48106.

Call for Computer Musicians and Artists

The fourth Personal Computer Arts Festival, in conjunction with the Personal Computing '81 Show at the Philadelphia Civic Center, will be Aug. 28–30, 1981. The festival will include technical sessions, demonstrations, exhibits, computer music, and a computer graphics film/video presentation.

Persons who would like to speak, perform, demonstrate or display should send a one-half page description of topic or performance (include tapes, prints or slides) by July 1 to PCAF-81, Box 1954, Philadelphia, PA 19105.

Hamfest/Computer Show

The Maryland FM Association's annual Hamfest/Computer show will be Sunday, May 31, at the Howard County Fairgrounds in West Friendship, MD, from 8 AM to 4 PM. Admission is $3 donation; tailgating—$2; tables—$6.

For information, write MFMA, c/o Heru Walmsley, Post Office, Harmans, MD 21077. 301-766-3545.

Europe Software 1981

Europe Software 1981 will run from June 2–4 in Utrecht, The Netherlands. This international exhibition is billed as a promotion for the transfer of information about computer software products, software services, bureau services and education in information science. Inquiries should be addressed to Royal Netherlands Industries Fair, PO Box 8500, 3503 RM Utrecht, The Netherlands. Telephone: (30) 914 914, Telex: 47132.

Amateur Fair

The North Area Repeater Association will sponsor the state's largest swapfest and exposition for computer hobbyists and radio amateurs on May 30 at the Minnesota State Fairgrounds in St. Paul. Exhibits, booths and prizes will be featured. For information or reservations, write Amateur Fair, PO Box 30054, St. Paul, MN 55175.

London Micro Show

The 1981 Microcomputer Show will be held July 29–31, 1981, at the Wembley Conference Centre, London, England. A conference program running concurrently with the exhibition will highlight micro applications in business, production and in education. Proposed topics for conference sessions include hardware availability, software packages, and devclopment, automatic test equipment, robotics and process control.

The 1981 Microcomputer Show is organized by Online Conferences, also the organizers of Viewdata 80, the first world conference on viewdata, videotext and teletext.

Potential exhibitors should contact Jeff Wolf at 800-227-3477; in Canada and California, call 415-474-3000 or write TMAC, 680 Beach St., Suite 428, San Francisco, CA 94109.

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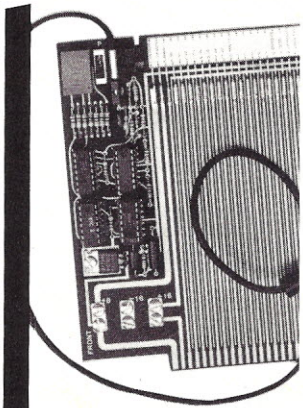
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Wanted: Information where I can find the King James version of the Bible in computer readable format on disk or cassette. Steven Tilden, 4771 S. Warren Ave., Tucson, AZ 85714. 602-746-0569. I will accept collect calls if you have this information.

Memory boards from bankruptcy sale. Limited quantity of 16K dynamic RAMs. Configured for 18 bits, 8K words or 9 bits, 16K bytes, on board refresh & add. to 20 bits. Schematics, interface information & 110-pin gold plated, wire-wrap connector. Functionally tested 1-3 @ $100, 3-5 @ $85. Untested and others from $40. TMI, 2000 N. Highway 67, Florissant, MO 63033. 314-837-8338.

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For Sale: Altair 8800 with 32K RAM, 88-2SIO, 88-ACR, Microsoft Extended BASIC in ROM, complete documentation, factory-assembled chassis: $1000, plus shipping. ASR-33 Teletype with tape reader/punch, stand and manuals, factory-reconditioned: $400, plus shipping. Gene Szymanski, 693 Rosedale Road, Princeton, NJ 08540. Phone 609-924-8856, evenings.

Have purchased a mini. Selling all my micro equipment and lots of software for CP/M and North Star with it. Send SASE for a list of equipment and software. RK&B, Inc., PO Box 178, Kechi, KS 67067.

Heath H11 64K, serial board, H19 CRT, H27 floppy, 6 months old; $6700 new, asking $5500. Tom Golway, 350 Richard Ave., Staten Island, NY 10309. 212-948-7288.

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For Sale: SYM computer, 5V 3A pwr supply, TVT 6 5/8 (you finish assembly), all manuals, etc. $250 or best offer. Glenn 212-694-5128, late eve. ok.

For Sale: OSI C4P computer, 8K RAM, 8K BASIC in ROM. Used 6 mos. Original factory carton. Includes 19" B/W TV, Chnl. 16 modulator, cass. recorder, keypads. Also, $200 worth of software & documentation, incl. Sams manual. Worth $1200. First certified check for $650 gets it. I pay shipping. Craig Neth, RR 12, Box 401, Columbus, IN 47201.

For Sale: H8, serial I/O, 20K RAM, cassette recorder, all documentation included. First cashier's check for $600 takes. I ship. M. H. Endres, Box 8, Spirit Lake, ID 83869. 208-623-5911.

For Sale: ASR-33 Teletype with stand and service manuals. In good working order. $250 plus shipping, or best offer. Dick Carney, 1927 Dewey, Bartlesville, OK 74003. 918-336-3731.

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VisiCalc user's note. New user's group formed for you and those interested in business applications. TRS-80, Apple. Quarterly newsletter, $7.50. Micro-Calc Business User's Group, PO Box 12039, Salem, OR 97309.

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For Sale: SWTP 6802 syst/parts, B2 mainfrm, MPA2 MPU, 40K RAM, serial/parallel cards, Percom LFD400 FDC, EPROM prg, calc. card—$900; H19 term., Base 2 prt—$1300 w/syst HiPlot DMP2 plot—$800; Hewlett-Packard 85 computer, 4 software packs, 6 data cassettes, 2 paper rolls—little use in 9 months—$2900. Doug Ramers, Box 1008, Dover, DE 19901. 302-674-6386 (days).

For Sale: OSI C4P-MF w/24K, floppy disk, color graphics, D/A converter. Faster than Apple and TRS-80. Under warranty. P. Mulieri, 4 Robinhood Lane, E. Setauket, NY 11733. 516-751-5705 (after 7 PM).

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CLUB NOTES

Silicon Valley 68XX Users Group

The 68XX Users Group of Silicon Valley in Northern California is now recruiting new members who are interested in 68XX microprocessors and hobbyist applications. Meetings are held on the second Tuesday of each month in Santa Clara at American Microsystems, Inc. Advance registration is required. For more information, send a self-addressed stamped envelope to 68XX Users Group, PO Box 18081, San Jose, CA 95158.

Tri-State (IA, WI, IL) Microcomputer Club

A membership drive is also being conducted by the Tri-State Area Microcomputer Club for those microprocessor users interested in the exchange of ideas. Queries should be addressed to John Gruber, 2866 Brueck, Dubuque, IA 52001.

Portland Computer Society

The Portland Computer Society (PCS) holds its monthly meetings every third Saturday. For further information, contact Portland Computer Society, PO Box 17371, Portland, OR 97217.

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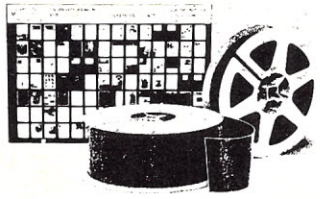
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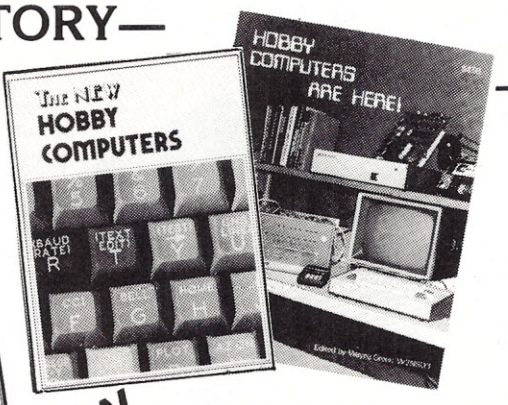
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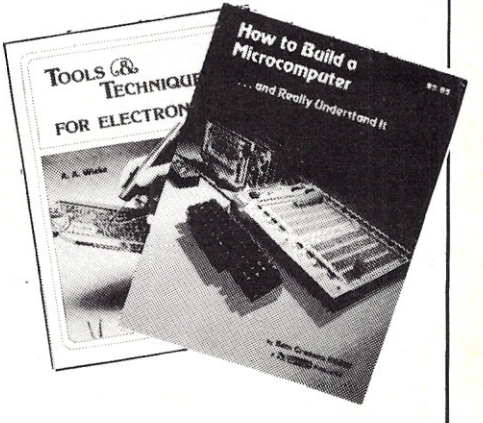
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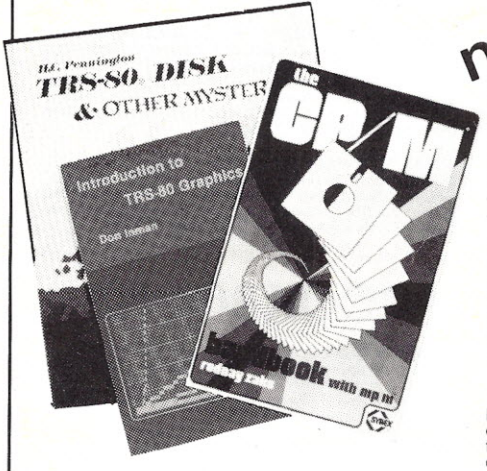
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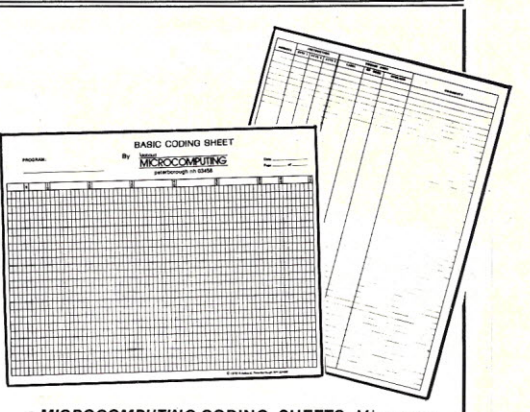
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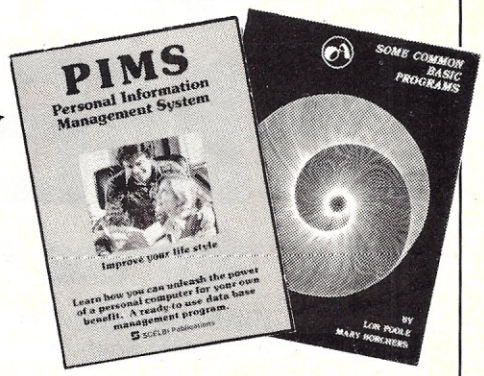
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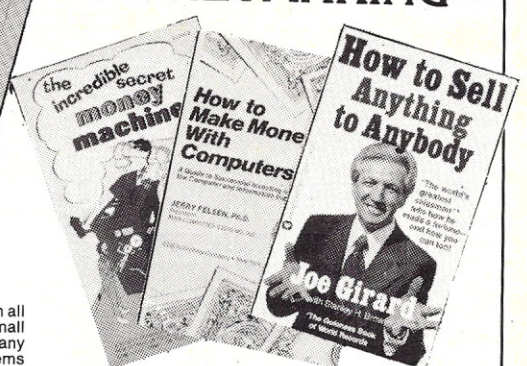


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	IBM Compatible (128 B/S, 26 sectors)	3080	2.19	5FD-111110	473071	53428	CM-F11	800506	2305830	40013	FD1-128	FD-1	740-0	S/A 100	15002	FD34-1000	F111111X	7870-K	421602
Flexible Disc 1s	IBM Compatible (128 B/S, 26 sectors) w/ W.P.N.	3082	2.24	–	–	–	–	–	–	–	–	–	740-0	–	–	–	–	–	–
	IBM Compatible (128 B/S, 26 sectors) w/ W.P.N. & Hub ring	3084	2.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Single-Headed Drives	IBM Compatible (128 B/S, 26 sectors) REVERSIBLE	1729	3.35	5FD-113110	473072	54431	–	–	–	40015	–	FD-2	740/2-0	–	15150	FF34-2000	F171111X	7860-K	–
Single-Density Media	IBM System 6 Compatible	3066	2.19	–	473077	54561	–	800509	1669959	40014	–	–	740-0 DS6	–	15003	FD60-1000	F116111X	–	–
	IBM Compatible (256 B/S, 15 sectors)	3109	2.19	5FD-111210	473073	–	–	800584	2305845	40040	–	–	740-3600	–	15005	FD36-1000	F112111X	7861-K	–
	IBM Compatible (512 B/S, 8 sectors)	3110	2.19	–	473074	–	–	800585	1669954	40044	–	–	–	–	15004	FD60-1000	F113111X	7889-K	–
	Shugart Compatible, 32 hard sector	3015	2.19	5FD-211010	470901	53802	CM-F21	101/1	–	40016	FH1-32	FD-132	740-32	S/A-101	15025	FD32-1000	–	7890-K	421322
	Shugart Compatible, 32 hard sector REVERSIBLE	3025	3.35	5FD-213010	–	–	–	–	–	40017	–	–	740/2-32	–	15151	FF32-2000	–	7880-K	–
	Wang Compatible, 32 hard sector w/Hub ring	3087	2.50	–	–	54491	–	–	–	–	–	–	740-32RM	–	–	–	F37A411X	–	–
	CPT 8000 Compatible	3045	2.79	–	–	–	–	–	–	–	–	–	–	–	15226	–	–	–	–
Flexible Disc 1d	IBM Compatible (128 B/S, 26 sectors)	3090	2.95	5FD-121010	474071	54568	–	3740/10	–	40047	FD1-128/M2100	FD-1D	741-0	–	–	FD34-8000	F131111X	7857-K	423002
	Soft Sector (128 B/S, 26 sectors) REVERSIBLE	3093	3.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Single-Headed Drives	Shugart Compatible, 32 hard sector	3091	2.95	5FD-221010	470801	54596	–	101/1D	–	40024	FH1-32D	–	741-32	S/A-103	15075	FD32-8000	F33A410X	7887-K	423322
Double-Density Media	Shugart Compatible, 32 hard sector REVERSIBLE	3094	3.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Wang Compatible, 32 hard sector w/Hub ring	3088	3.20	–	–	–	–	–	–	–	–	–	–	–	–	–	F22A411X	–	–
Flexible Disc 2s	Soft Sector (Unformatted)	3101	3.84	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Soft Sector (128 B/S, 26 sectors)	3113	3.84	–	–	54428	–	800814	1766870	–	–	–	–	S/A-150	15153	FD10-4026	F121111X	–	–
Double-Headed Drives	Soft Sector (256 B/S, 15 sectors)	3106	3.84	–	473477	54226	–	800815	2736700	40043	FD2-256D	–	742-0	–	15154	FD10-4015	F122111X	7856-K	424612
Single-Density Media	32 Hard Sector	3108	3.84	–	–	–	–	–	–	–	FH2-32	–	–	–	–	–	–	–	–
Flexible Disc 2d	Soft Sector (Unformatted)	3102	3.49	–	473485	–	–	DY150	–	40028	FD2-XDM	FD-2D	743-0	–	15103	DD34-4001	–	–	425002
	Soft Sector (128 B/S, 26 sectors)	3115	3.49	–	–	–	–	–	–	–	–	–	–	S/A-150	–	–	–	–	–
Double-Headed Drives	Soft Sector (256 B/S, 26 sectors)	3103	3.49	–	473471	54325	–	800817	1766872	40019	FD2-2560	–	743-0/256	–	15101	DD34-4026	F144111X	7858-K	425602
Double-Density Media	Soft Sector (512 B/S, 15 sectors)	3114	3.49	–	473472	54479	–	800818	1669044	40039	–	–	743-0/512	–	15100	DD34-4015	F145111X	–	425612
	Soft Sector (1024 B/S, 8 sectors)	3104	3.49	–	473473	54485	–	800819	1669045	40020	–	–	743-0/1024	–	15102	DD34-4008	F147111X	7859-K	425622
	32 Hard Sector	3105	3.49	5FD-321010	470851	–	–	101/2D	–	40021	FH2-32D	–	743-32	S/A-151	15125	DD32-4000	F34A411X	7881-K	425322
	Burroughs B-80 Compatible 32 Hard Sector	3092	3.49	–	–	–	–	–	–	–	–	–	–	–	–	–	F34A611X	–	–
	Soft Sector (1024 B/S, 8 sectors) w/ Hub Ring	3116	3.75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Flexible Disc FD																			
Memorex 651 or Equiv. Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.95	–	470651	–	CM-F31	FDIV	–	40002	–	FD-165	511-0	–	15026	FD65-1000	F61A111X	7910	–
Mini Flexible Disc 1s	Soft Sector (Unformatted)	3401	1.99	–	475001	54256	–	104/1	–	40500	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	7897	441002
5¼" Single-Headed Drives	10 Hard Sector	3403	1.99	–	475010	54257	–	107/1	–	40501	–	MD 110	744-10	S/A-107	15325	MD525-10	M41A211X	7898	441102
Single-Density Media	16 Hard Sector	3405	1.99	–	475016	54258	–	105/1	–	40502	MH1	MD 116	744-16	S/A-105	15326	MD525-16	M51A211X	7899	441162
	Soft Sector (Unformatted) W/Hub Ring	3431	2.19	–	–	–	–	–	–	–	–	–	–	–	–	MD525-01	–	–	–
	10 Hard Sector, w/Hub Ring	3433	2.19	–	–	–	–	–	–	–	–	–	–	–	–	MD525-10	–	–	–
	16 Hard Sector, w/Hub Ring	3435	2.19	–	–	–	–	–	–	–	–	–	–	–	–	MD525-16	–	–	–
Mini Flexible Disc 1d	Soft Sector	3417	2.24	–	–	54646	–	104/1D	–	–	–	–	–	–	–	MD540-01	–	–	–
5¼" Single-Headed Drives	10 Hard Sector	3418	2.24	–	–	54649	–	107/1D	–	–	–	–	–	–	–	MD540-10	–	–	–
Double-Density Media	16 Hard Sector	3423	2.24	–	–	54652	–	105/1D	–	–	–	–	–	–	–	MD540-16	–	–	–
Mini Flexible Disc 2d	Soft Sector	3421	2.74	–	–	54624	–	104/2D	–	–	MD2-D	–	745-0	S/A-154	–	MD550-01	–	–	–
5¼" Double-Headed Drives	10 Hard Sector	3423	2.74	–	–	54627	–	107/2D	–	–	–	–	745-10	S/A-157	–	MD550-10	–	–	–
Double Density Media	16 Hard Sector	3425	2.74	–	–	54630	–	105/2D	–	–	MH2-D	–	745-16	S/A-155	–	MD550-16	–	–	–

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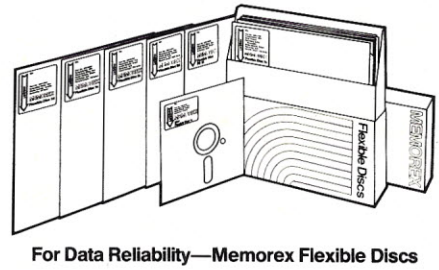
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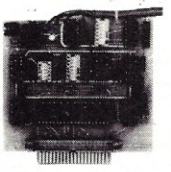
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TRS-80 SERIAL I/O

• Can input into basic • Can use LLIST and LPRINT to output, or output continuously • RS-232 compatible • Can be used with or without the expansion bus • On board switch selectable baud rates of 110, 150, 300, 600, 1200, 2400, parity or no parity odd or even, 5 to 8 data bits, and 1 or 2 stop bits. D.T.R. line • Requires +5, -12 VDC • Board only $19.95 Part No. 8010, with parts $76.69 Part No. 8010A, assembled $98.25 Part No. 8010C. No connectors provided, see below.





EIA/RS-232 connector Part No. DB25P $6.00, with 9' 8 conductor cable $19.65 Part No. DB25P9.



3' ribbon cable with attached connectors to fit TRS-80 and our serial board $37.10 Part No. 3CAB40.

VIDEO TERMINAL



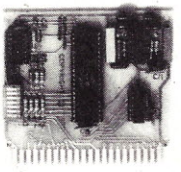
16 lines, 64 columns • Upper and lower case • 5x7 dot matrix • Serial RS-232 in and out with TTL parallel keyboard input • On board baud rate generator 75, 110, 150, 300, 600, & 1200 jumper selectable • Memory 1024 characters (7-21L02) • Video processor chip SFF96364 by Neculonic • Control characters (CR, LF, →, ←, ↑, ↓, non destructive cursor, CS, home, CL • White characters on black background or vice-versa • With the addition of a keyboard, video monitor or TV set with TV interface (part no. 107A) and power supply this is a complete stand alone terminal • also S-100 compatible • requires +16, & −16 VDC at 100mA, and 8VDC at 1A. Part No. 1000A $296.45 kit.

GAME PADDLES & SOUND FOR TRS-80



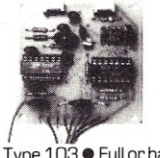
Includes: 2 game paddles, interface, software, speaker, power supply, full documentation including: schematics, theory of operation, and user guide; plus 2 games on cassette, Pong and Starship War $157.29 Complete Part No. 7922C

SERIAL/ PARALLEL INTERFACE



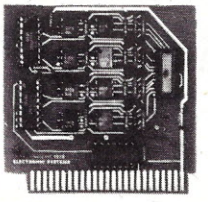
• Converts serial to parallel and parallel to serial • Low cost on board baud rate generator • 110 to 19.2K • Low power drain +5 volts and -12 volts required • TTL compatible • All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity. • All connections go to a 44 pin gold plated edge connector • Board only $11.95 Part No. 101, with parts $42.89 Part No. 101A, 44 pin edge connector $4.00 Part No. 44P

MODEM



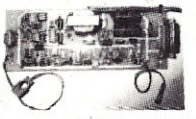
• Type 103 • Full or half duplex • Works up to 300 baud • Originate or Answer • Serial TTL input and output • connect 8 Ω speaker and crystal mic. directly to board • Requires +5 volts • Board only $7.60 Part No. 109, with parts $29.95 Part No. 109A.

OPTO-ISOLATED PARALLEL INPUT BOARD FOR APPLE II



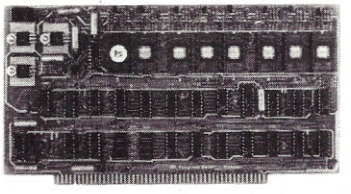
There are 8 inputs that can be driven from TTL logic or any 5 volt source. The circuit board can be plugged into any of the 8 sockets of your Apple II. It has a 16 pin socket for standard dip ribbon cable connection. Board only $15.65 Part No. 120, with parts $69.95. Part No. 120A.

SUPER MODEM



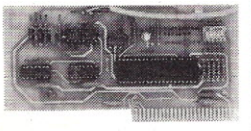
Originate, RS-232 and 20 mA compatable. Full duplex, and half duplex, direct connect or acoustic coupled, on board power supply, carrier detect light, DB25 plug, 300 BAUD, Type 103 compatable frequencies. Bare board Part No. 2000 $21.89, Kit Part No. 2000A $133.80

8K EPROM SAVER



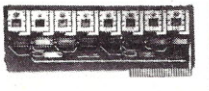
• Programs 2708's address relocation of each 4K of memory to any 4K boundary • Power on jump and reset jump option for "turnkey" systems and computers without a front panel • Program saver software in 1 2708 EPROM $25. Bare board $45.59 including custom coil, board with parts but no EPROMS $164.69.

APPLE II SERIAL I/O INTERFACE



Baud rate is continuously adjustable from 0 to 30,000 • Plugs into any peripheral connector • Low current drain. RS-232 input and output • On board switch selectable 5 to 8 data bits, 1 or 2 stop bits, and parity or no parity either odd or even • Jumper selectable address • SOFTWARE • Input and Output routine from monitor or BASIC to teletype or other serial printer • Program for using an Apple II for a video or an intelligent terminal. Also can output in correspondence code to interface with some selectrics. • Also watches DTR • Board only $14.95 Part No. 2, with parts $51.25 Part No. 2A, assembled $62.95 Part No. 2C

PARALLEL TRIAC OUTPUT BOARD FOR APPLE II



This board has 8 triacs capable of switching 110 volt 6 amp loads (660 watts per channel) or a total of 5280 watts. Board only $15.65 Part No. 210, with parts $119.95 Part No. 210A

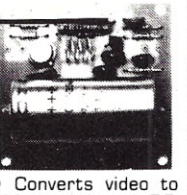
APPLE II PROTOTYPING HOBBY/CARD

Part No. 7907 $21.95

RS-232/20mA INTERFACE

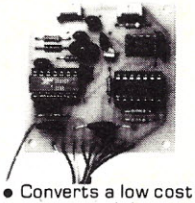
This board has two passive, opto-isolated circuits. One converts RS-232 to 20mA, the other converts 20mA to RS-232. All connections go to a 10 pin edge connector. Requires +12 and -12 volts. Board only $9.95, part no. 7901, with parts $14.95 Part No. 7901A.

T.V. INTERFACE



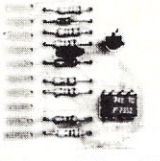
• Converts video to AM modulated RF, Channels 2 or 3. So powerful almost no tuning is required. On board regulated power supply makes this extremely stable. Rated very highly in Doctor Dobbs' Journal. Recommended by Apple • Power required is 12 volts AC C.T., or +5 volts DC • Board only $8.19 part No. 107, with parts $18.85 Part No. 107A

TAPE INTERFACE



• Converts a low cost tape recorder to a digital recorder • Works up to 1200 baud • Digital in and out are TTL-serial • Output of board connects to mic. in of recorder • Earphone of recorder connects to input on board • No coils • Requires +5 volts, low power drain • Board only $7.60 Part No. 111, with parts $29.95 Part No. 111A

RS-232/TTL INTERFACE



• Converts TTL to RS-232, and converts RS-232 to TTL • Two separate circuits • Requires -12 and +12 volts • All connections go to a 10 pin edge connector, kit $9.95 Part No. 232A 10 Pin edge connector $3.00 part No. 10P.

S-100 BUS ACTIVE TERMINATOR



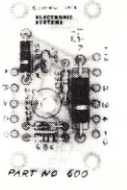
Board only $18.15 Part No. 900, with parts $29.89 Part No. 900A.

SERIAL I/O



Four Serial I/O RS-232 ports. S-100 Bus, Software or jumper selectable baud rate (110, 300, 600, 1200, 2400, 4800, 9600, 19.2K), on board Xtal baud rate generator, Addressing, switch selectable, Parity or no parity (odd or even) switch selectable. 1 or 2 stop bits, 5 to 8 bits/character. Board only $35.19 Part No. 7908. With parts (kit) $199.95, Part No. 7908A.

RS-232/TTY INTERFACE



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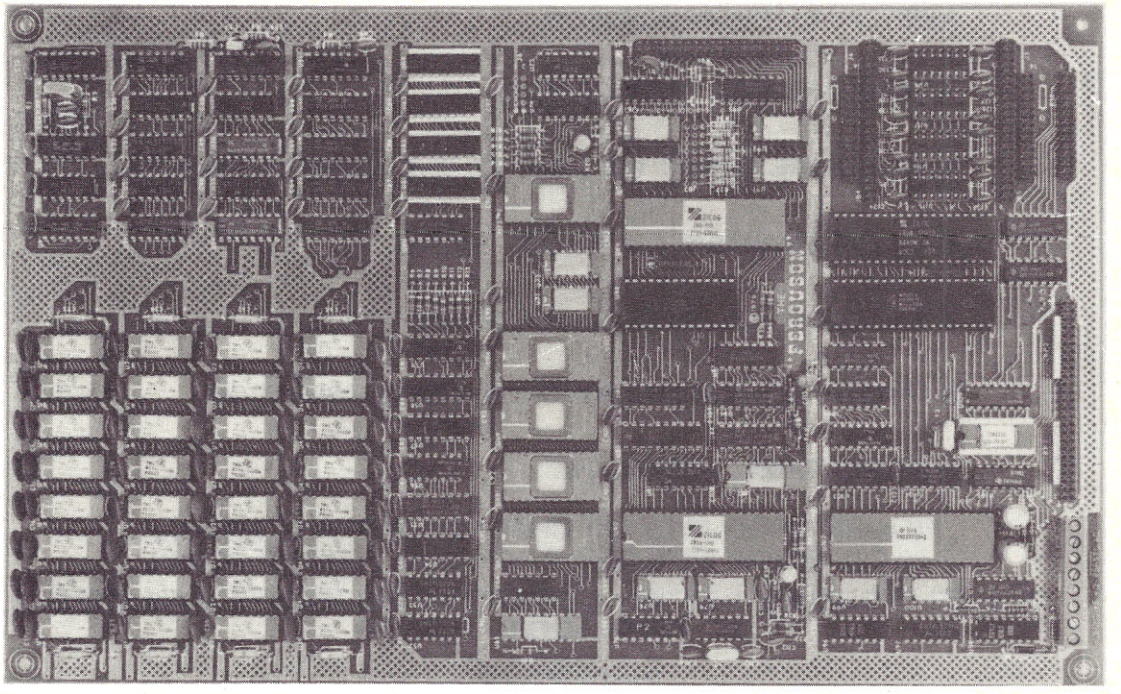
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Z-80 CPU! 64K RAM!

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For All Sockets Installed
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THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, an enclosure, C.R.T., and you have a total Business System for about 1/3 the cost you might expect to pay.

$649.00 ** (64K KIT BASIC I/0)

SIZE: 8½ x 13¾ IN.
SAME AS AN 8 IN. DRIVE.
REQUIRES: +5V @ 3 AMPS
+ - 12V @ .5 AMPS.

FULLY SOCKETED!

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232. For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $85.

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix - Upper & Lower Case

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

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Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $29.95

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $14.95

SYSTEM COMPARISON

64K RAM KIT	$370.00
80 x 24 Video Kit	365.00
Floppy Disk Controller Kit	235.00
Z-80 CPU Kit	185.95
SER & PAR. I/O	129.95
S-100 Mother Board	45.00
SUB TOTAL	$1330.90

Talk about bangs per buck! The prices shown for S100 kits were taken from the July 1980 BYTE. This will give some basis for comparison between the Big Board and a similar system implementation on the S100 Buss.

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. modified by MICRONIX SYSTEMS to run on Big Board is available for $150.00.

PC BOARD

Blank PC Board with Rom Set and Full Documentation.
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The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided.

Z-80 is a Trademark of Zilog.

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TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD's (for the Big Board only) with a $75 deposit. Balance UPS COD. Add $3.00 shipping.

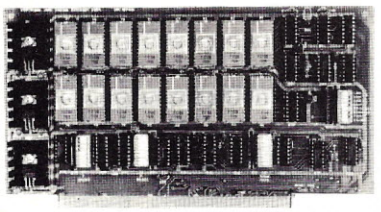
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USES 2716's

Blank PC Board - $34

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SPECIAL: 2716 EPROM's (450 NS) Are $11.95 EA. With Above Kit.

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8. Double sided PC board, solder-masked, silk-screened.
9. Gold plated contact fingers.
10. Unselected EPROM's automatically powered down for low power.
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

32K SS-50 RAM

$379.00 KIT

For 2MHZ Add $10

Blank PC Board $50

For SWTPC 6800 - 6809 Buss

Support IC's and Caps $19.95

Complete Socket Set $21.00

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At Last! An affordable 32K Static RAM with full 6809 Capability.

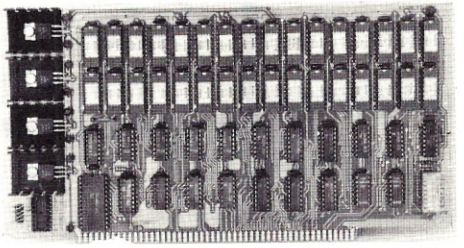
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16K STATIC RAM KIT-S 100 BUSS

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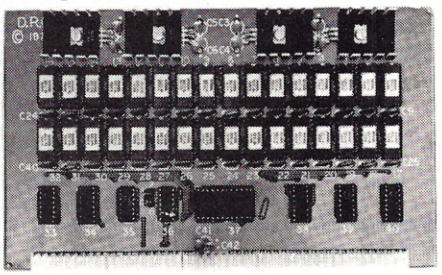
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KIT FEATURES:
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3. Fully Bypassed
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5. All Parts and Sockets included
6. Low Power: Under 1.5 Amps Typical

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At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

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Both Basic and Assembly Language Programming examples are included.

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4K DYNAMIC RAM BLOWOUT!
SAME AS INTEL 2107B!
4K RAMS AT AN UNBELIEVABLE 50¢ EACH!!!

Prime, new, National Semi., 1979 date coded, full spec. parts. N.S. #MM5280-5N. Same as INTEL 2107B-4, T.I. TMS4060, NEC uPD411, etc. We bought a HUGE QTY. from a West Coast Distributor at truly DISTRESS PRICES! One of the most popular and reliable RAM's ever made. These parts have been used by almost all Major Computer Main Frame Mfg. the world over! Arranged as 4K x 1, 270 NS Access Time, 22 Pin Dip. These units DO NOT use multiplexed addressing, thus making REFRESH and other timing very simple. See INTEL MEMORY DESIGN HANDBOOK for full application notes. The NAT. SEMI. MEMORY DATA BOOK is available at most Radio Shack Stores. Prime units in original factory tubes!

#5280-5N 4096 BITS x 1 270 NS ACCESS

(With Pin Out Data)

8 FOR $4.95 32 FOR $16

FACTORY CASE (450 PCS) — $180

Sockets Special: 22 Pin Low Profile (With Purchase of 5280's) 8 FOR $1.

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video 100



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KIT CONTAINS DIP SWITCHES AND DETAILED INSTRUCTIONS

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74LS10	.26
74LS20	.26
74LS21	.28
74LS22	.26
74LS26	.49
74LS27	.26
74LS30	.28
74LS32	.32
74LS38	.32
74LS42	.65
74LS48	.78
74LS51	.25
74LS54	.35
74LS74	.38
74LS75	.60
74LS83	.44
74LS85	.95
74LS86	.95
74LS90	.69
74LS93	.69
74LS107	.45
74LS112	.38
74LS113	.48
74LS122	.48
74LS123	.95
74LS126	.69
74LS138	.69
74LS151	.44
74LS153	.44
74LS155	1.15
74LS158	.75
74LS160	.95
74LS161	.85
74LS162	.95
74LS163	1.60
74LS164	.65
74LS165	.65
74LS170	1.75
74LS174	.75
74LS175	.75
74LS190	.75
74LS193	.95
74LS195	.95
74LS196	.85
74LS221	1.40
74LS240	1.65
74LS241	1.65
74LS243	1.45
74LS244	1.45
74LS245	2.25
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- Seconds, minutes, hours, day-of-week month, date, & year.
- On board batteries with one year life.
- Uses MSM5832 crystal controlled.

California Computer Systems

APPLE INTERFACE CARDS

CENTRONICS PRINTER	$ 219
COMMUNICATIONS W/Accom. & cable	189
DUAL II CONTROLLER d.d.-c. 5.1	149
INTEGER BASIC FIRMWARE	195
APPLESOFT FIRMWARE	195
PASCAL LANGUAGE PACKAGE	449
PARALLEL PRINTER	175
PROTOTYPING/HOBBY	25
ZEMAN PACKAGE	109

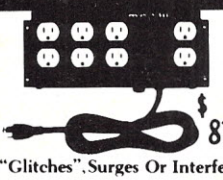
S-100

16 K STATIC MEMORY BD.	$ 299
32 K STATIC MEMORY BD.	499
64 K DYNAMIC MEMORY BD.	525
MOTHERBOARD, 12 SLOT	195
Z-80 CPU BD.	289
MAINFRAME W/P.S. & MOM.	379
DISK CONTROLLER BD.	345

MSM5832 MICROPROCESSOR REAL-TIME CLOCK/CALENDAR $7.45

GENERAL DESCRIPTION

The MSM5832 is a monolithic metal-gate CMOS integrated circuit that functions as a real time clock calendar for use in bus-oriented microprocessor applications. The on-chip 32.768 Hz crystal controlled oscillator time base is counted down to provide addressable 4-bit I/O data of SECONDS, MINUTES, HOURS, DAY-OF-WEEK, DATE, MONTH and YEAR. Data access is controlled by 4-bit address, chip select, read, write and hold inputs. Other functions include 12H/24H format selection, leap year identification and manual 30 second correction.



$8.75

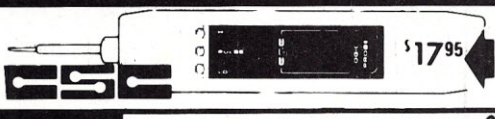
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2716	2k x 8 triple p.s.	6.95



$17.95
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SN7402N	.22	SN7492N	.50
SN7404N	.22	SN7493N	.48
SN7408N	.24	SN7495N	.60
SN7410N	.22	SN7496N	.70
SN7412N	.28	SN74122N	.39
SN7413N	.35	SN74136N	.95
SN7414N	.49	SN74141N	.69
SN7416N	.29	SN74151N	.65
SN7417N	.29	SN74153N	.65
SN7423N	.28	SN74154N	1.25
SN7425N	.25	SN74155N	.80
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SN7437N	.29	SN74160N	.95
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SN7440N	.22	SN74163N	.85
SN7442N	.57	SN74164N	.87
SN7443N	.78	SN74165N	.87
SN7445N	.78	SN74174N	.95
SN7451N	.20	SN74175N	.69
SN7454N	.20	SN74180N	.75
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SN7475N	.32	SN74393N	1.69

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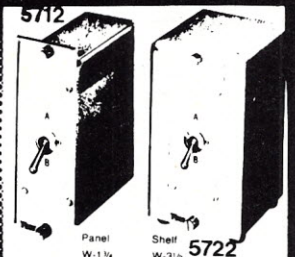
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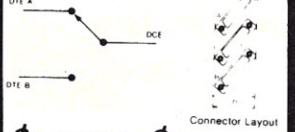
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5712 / 5722



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Shelf W-3½ H-5¼



Connector Layout

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Global Specialties

Logic Probes



LP1 $37.49

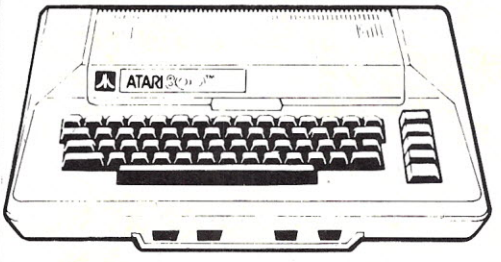


LP2 $21.49



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NEW! DISK 1: A SUPERB DISK CONTROLLER. A/T $495, CSC $595

Finally, a disk controller worthy of the **CompuPro** name. This state of the art design uses properly implemented DMA **with arbitration**, meaning that **Disk 1** can co-exist–without any conflict whatsoever–on the same bus as other DMA devices. And because **Disk 1** has 24 bit DMA addressing capability, you have disk access to a full 16 megabyte memory map.

Speed? **Disk 1** transfers data independently of CPU speed, and operates efficiently with older 2 MHz CPUs as well as the new 10 MHz 8086s. Versatility? **Disk 1** handles up to four 8" or 5.25" floppy disk drives (including 96 track high density minifloppies), single or double sided, single or double density (soft sectored). Convenience? **Disk 1** includes BIOS for CP/M-80*, as well as on-board boot for automatic startup and on-board 3 wire interface for system initialization. Compatibility? **Disk 1** is compatible with MP/M*, CP/M, OASIS*, CP/M-80, and CP/M-86. Reliability? Uses industry-standard, third generation controller chips and the same design excellence that is a part of every **CompuPro** product.

We weren't going to put out another me-too disk controller...and we didn't. The CompuPro Disk Controller is here.

S-100 HIGH SPEED MOTHERBOARDS

Actively terminated, fully shielded motherboards handle clock speeds up to 10 MHz. **Unkits** have edge connectors and termination resistors presoldered in place for easy assembly.

20 slot motherboard with edge connectors – Unkit **$174**, A/T **$214**
12 slot motherboard with edge connectors – Unkit **$129**, A/T **$169**
6 slot motherboard with edge connectors – Unkit **$89**, A/T **$129**

MEMORIES FROM THE MEMORY LEADER

CompuPro memories feature fully static design to eliminate dynamic timing problems, full conformance to all IEEE 696/S-100 specifications, high speed operation (4/5 MHz Unkit, 10 MHz A/T and CSC), low power consumption, extensive bypassing, and careful thermal design.

	Unkit	A/T	CSC
8K RAM 2A	**$159**	**$189**	**$239**
16K RAM 14 (extended addressing)	**$279**	**$349**	**$429**
16K RAM 20-16 (extended addressing and bank select)	**$319**	**$399**	**$479**
24K RAM 20-24 (extended addressing and bank select)	**$429**	**$539**	**$629**
32K RAM 20-32 (extended addressing and bank select)	**$559**	**$699**	**$799**

NEW! 64K RAM 17. Amazingly low power in a 64K **fully static** RAM board: draws less than 1.75 Watts typical, 2.5 Watts max! It's fast, too; runs with 6 MHz Z-80* CPUs, or up to 10 MHz with 8086/88 family CPUs. Uses IEEE extended addressing protocol; also, user may turn off 2K windows from E000 to FFFF in order to accommodate memory-mapped peripherals/disk controllers. (The **CompuPro** disk controller can use the full 64K since it employs properly implemented DMA techniques). **$1095** Unkit, **$1395** A/T, **$1595** CSC.

Most **CompuPro** products are available in **Unkit** form, **Assembled/Tested**, or qualified under the high-reliability **Certified System Component (CSC)** program (200 hour burn-in, more). Note: **Unkits** are not intended for novices, as de-bugging may be required due to problems such as IC infant mortality. Factory service is available for **Unkits** at a flat service charge.

SYSTEM SUPPORT 1

$295 Unkit, $395 A/T, $495 CSC

This multi-purpose S-100 board provides sockets for 4K of extended address EPROM or RAM (2716 pinout) with one battery backup socket; battery backup month/day/year/time crystal clock with BCD outputs; optional math processor (9511 or 9512); full RS-232 serial port; three 16 bit interval timers (cascade or use independently); two interrupt controllers service 15 levels of interrupts; power fail indicator; and comprehensive owner's manual with numerous software examples. Conforms fully to all IEEE 696/S-100 standards. (Add $195 to the above prices for the optional 9512 math processor.)

COMPUTER ENCLOSURE 2

$825 desk top version, $895 rack mount version

Includes fused, constant voltage power supply (+8A at 25 Amps, +16V at 3 Amps, and −16V at 3 Amps); 20 slot shielded/active terminated motherboard; and rugged all-metal enclosure with dual AC outlets on rear, heavy-duty line filter, circuit breaker, quiet ventilation fan, and reset switch. Rack mount version includes slides for easy pull-out from rack frame.

Also available: COMPUTER ENCLOSURE 1. Same as above, but less power supply and motherboard. **$289** desktop, **$329** rack mount.

HIGH SPEED S-100 CPU BOARDS

CompuPro CPU boards meet all IEEE 696/S-100 specifications (including timing). **CPU 8085/88** uses two processors,an 8085 and 8088, to provide both 16 and 8 bit capability with a standard 8 bit bus.

8 Bit CPU Z (with Z80A* CPU)..... **$225** Unkit, **$295** A/T, **$395** CSC.
8 Bit CPU 8085..... **$235** Unkit, **$325** A/T, **$425** CSC.
16/8 Bit CPU 8085/88..... **$295** Unkit, **$425** A/T (both operate at 5MHz); **$525** CSC (with 5 MHz 8085, 6 MHz 8088).

SOFTWARE

8088/8086 MONITOR-DEBUGGER: Supplied on single sided, single density, soft sectored 8" disk. CP/M* compatible. Great development tool; mnemonics used in debug conform as closely as possible to current CP/M* DDT mnemonics. **$35.**

PASCAL/M* FROM SORCIM: PASCAL–easy to learn, easy to apply–can give a microcomputer with CP/M* more power than many minis, and SORCIM's PASCAL is the best we've been able to find regardless of price. We supply a totally standard **Wirth PASCAL/M* 8" disk** and comprehensive manual. Specify Z-80* or 8080/8085 version. **$175.**

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SN7437N	.25	SN74125N	.49	SN74194N	.89
SN7438N	.40	SN74126N	.49	SN74195N	.69
SN7439N	.25	SN74132N	.75	SN74196N	.89
SN7440N	.20	SN74136N	.75	SN74197N	.89
SN7441N	.89	SN74141N	.99	SN74198N	1.49
SN7442N	.59	SN74142N	3.25	SN74199N	1.49
SN7443N	1.10	SN74143N	3.49	SN74221N	1.25
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SN7448N	.79	SN74150N	1.25	SN74284N	3.95
SN7450N	.20	SN74151N	.69	SN74285N	3.95
SN7451N	.20	SN74152N	.69	SN74365N	.69
SN7453N	.20	SN74153N	.79	SN74366N	.69
SN7454N	.20	SN74154N	1.25	SN74367N	.69
SN7459A	.25	SN74155N	.79	SN74368N	.69
SN7460N	.20	SN74156N	.79	SN74390N	1.49
SN7470N	.29			SN74393N	1.49

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74LS01	.29	74LS93	.75	74LS193	1.15
74LS02	.29	74LS95	.99	74LS194	1.15
74LS03	.29	74LS96	1.15	74LS195	1.15
74LS04	.35	74LS107	.45	74LS197	1.19
74LS05	.35	74LS109	.45	74LS221	1.19
74LS08	.29	74LS112	.45	74LS240	1.95
74LS09	.35	74LS113	.49	74LS241	1.95
74LS10	.29	74LS114	.49	74LS242	1.95
74LS11	.75	74LS122	.89	74LS243	1.95
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74LS14	.99	74LS126	.55	74LS247	1.19
74LS15	.35	74LS132	.99	74LS248	1.19
74LS20	.29	74LS133	.89	74LS249	1.19
74LS21	.35	74LS136	.49	74LS251	1.49
74LS22	.35	74LS138	.89	74LS253	.99
74LS26	.35	74LS139	.89	74LS257	.89
74LS27	.35	74LS151	.89	74LS258	.99
74LS28	.35	74LS153	.89	74LS260	.69
74LS30	.29	74LS154	1.75	74LS266	.69
74LS32	.35	74LS155	1.19	74LS273	1.95
74LS33	.59	74LS156	1.19	74LS279	.75
74LS37	.45	74LS157	1.19	74LS283	1.09
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74LS40	.35	74LS160	1.15	74LS293	.99
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74LS48	1.15	74LS163	1.15	74LS353	1.25
74LS51	.29	74LS164	1.25	74LS365	.75
74LS54	.29	74LS165	1.25	74LS366	.75
74LS55	.29	74LS166	1.25	74LS367	.75
74LS74	.45	74LS169	1.19	74LS368	.75
74LS75	.59	74LS170	2.49	74LS374	1.95
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74S03	.50	74S135	1.19	74S253	1.45
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CD4014	1.39	CD4048	1.35	CD4516	1.49
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CD4017	1.19	CD4051	1.19	CD4520	1.29
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DL-3130

MULTI-DIGIT REFLECTOR ARRAYS FOR CLOCKS

PART NUMBER	CHAR. HT. (IN.)	POLARITY	DESCRIPTION	LIGHT OUTPUT (MCD) TYP	MIN	@mA	FORWARD VOLTAGE SEGMENT (V) I_F = 20mA TYP	MAX	CONTINUOUS FORWARD CURRENT PER SEGMENT (mA) MAX	PRICE
DL-4500 (Red) DL-4507 (Red)	.50	C.C. MPX	4 Digit 7 Segment With Colon And Auxiliary Indicators	.8 ----	.5 1.0	10	1.7	2.0	30	2.49 2.49
DLG-4507 (orng) DLG-4507 (grn) DL-4520A (red)	.50	C.C. non MPX		.8	.5	10	1.7	2.0	30	4.95 4.95 2.49
DL-4120A (red)	1.0	C.C. non MPX		1.5	.9		3.4	4.0		4.95

MULTI-DIGIT REFLECTOR ARRAYS

DL-2300 (Red)	.30	C.C. MPX	7 Seg. 2 Digit D.P. Right	2.5	1.1	20	1.7	2.0	30	.99
DLG-2535 (green)	.50	C.A. MPX	9 Seg. 2 Digit		2.5	20		3.5	25	1.49
DL-4509 (Red)	.50	C.C. MPX	9 Seg. 4 Digit D.P. Right	.8	.5	10	1.7	2.0	30	2.49
DL-6500 (Red)	.50	C.C. MPX	7 Seg. 6 Digit D.P. Right	.8	.5	10	1.7	2.0	30	2.95
DL-6530 (Red)	.50	C.A. MPX	7 Seg. 6 Digit D.P. Right	.8	.5	10	1.7	2.0	30	2.95
DL-3130 (Red)	1.0	C.A. MPX	7 Seg. 3 Digit D.P. Right	1.5	1.0	10	3.4	4.0	30	3.95

DISCRETE LEDS

XC556R	.200"	red	5/$1	MV50	.085"	red	6/$1
XC556G	.200"	green	4/$1	XC209R	.125"	red	5/$1
XC556Y	.200"	yellow	4/$1	XC209G	.125"	green	4/$1
XC556C	.200"	clear	4/$1	XC209Y	.125"	yellow	4/$1
XC22R	.200"	red	5/$1	XC526R	.185"	red	5/$1
XC22G	.200"	green	4/$1	XC526G	.185"	green	4/$1
XC22Y	.200"	yellow	4/$1	XC526Y	.185"	yellow	4/$1
MV10B	.170"	red	4/$1	XC526C	.185"	clear	4/$1

XC111R	.190"	red	5/$1
XC111G	.190"	green	4/$1
XC111Y	.190"	yellow	4/$1
XC111C	.190"	clear	4/$1

XC556 RED LED, METAL MTG. HDW. 2-4" LEADS.

RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode

Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95
MAN 2	5x7 D.M.—red	.300	4.95
MAN 3	C.C.—red	.125	.25
MAN 52	C.A.—green	.300	1.25
MAN 54	C.C.—green	.300	1.25
MAN 71	C.A.—red	.300	.75
MAN 72	C.A.—red	.300	.75
MAN 74	C.C.—red	.300	1.25
MAN 82	C.A.—yellow	.300	.49
MAN 84	C.C.—yellow	.300	.99
MAN 3620	C.A.—orange	.300	.49
MAN 3630	C.A.—orange ± 1	.300	.99
MAN 3640	C.C.—orange	.300	.99
MAN 4610	C.A.—orange	.400	.99
MAN 6610	C.A.—orange—DD	.560	.99
MAN 6630	C.A.—orange ± 1	.560	.99
MAN 6640	C.C.—orange—DD	.560	.99
MAN 6650	C.C.—orange ± 1	.560	.99
MAN 6660	C.A.—orange	.560	.99
MAN 6710	C.A.—red—DD	.560	.99
MAN 6750	C.C.—red ± 1	.560	.99
MAN 6780	C.C.—red	.560	.99
DLO304	C.C.—orange	.300	1.25
DLO307	C.A.—orange	.300	1.25
DLG500	C.C.—green	.500	1.25

C.C. — Common Cathode

Type	Polarity	Ht	Price
DLG507	C.A.—green	.500	1.25
DL704	C.C.—red	.300	1.25
DL707	C.A.—red	.300	1.25
DL728	C.C.—red	.500	1.49
DL741	C.A.—red	.600	1.25
DL746	C.A.—red ± 1	.630	1.49
DL747	C.A.—red	.600	1.49
DL750	C.C.—red	.600	1.49
DLO847	C.A.—orange	.800	1.49
DLO850	C.C.—orange	.800	1.49
DL33B	C.C.—red	.110	.35
FND358	C.C. ± 1	.357	.99
FND359	C.C.	.357	.75
FND503	C.C. (FND500)	.500	.99
FND507	C.A. (FND510)	.500	.99
HDSP-3401	C.A.—red	.800	1.50
HDSP-3403	C.C.—red	.800	1.50
5082-7751	C.A., R.H.D.—red	.430	1.25
5082-7760	C.C., R.H.D.—red	.430	1.75
5082-7300	4x7 sgl. dig. RHD	.600	22.00
5082-7302	4x7 sgl. dig. LHD	.600	22.00
5082-7304	Overnge. char. (±1)	.600	19.95
4N28	Photo Xsistor Opto-Isol.		.99
LIT-1	Photo Xsistor Opto-Isol.		.69
MOC3010	Optically Isol. Triac Driver		1.25

SOCKETS

Test TEXTOOL Sockets

RECEPTACLES





ZERO INSERTION FORCE

* Nickel Boron Plating
* G.F. PSF Plastic Body
* For testing IC's

Part No.	Pins	Price
214-3339	14 pin	5.95
216-3340	16 pin	6.49
218-3341	18 pin	7.95
220-3342	20 pin	8.95
222-3343	22 pin	9.95
224-3344	24 pin	9.75
228-3345	28 pin	11.95
240-3346	40 pin	12.95

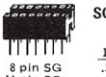
* Nickel Boron Plating
* G.F. PSF Plastic Body
* Wire Wrap Contacts

Part No.	Pins	Price
214-3592	14 pin	9.75
216-3593	16 pin	9.95
218-3594	18 pin	10.95
220-3595	20 pin	11.95
222-3596	22 pin	12.95
224-3597	24 pin	12.75
228-3598	28 pin	13.95
240-3599	40 pin	15.95



LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61



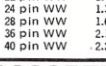
SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45



SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30



WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

ASST. 1	5ea.	10 Ohm	12 Ohm	15 Ohm	18 Ohm	22 Ohm			50pcs.	$1.95
		27 Ohm	33 Ohm	39 Ohm	47 Ohm	56 Ohm				
ASST. 2	5ea.	68 Ohm	82 Ohm	100 Ohm	120 Ohm	150 Ohm	180 Ohm	220 Ohm	50pcs.	$1.95
		270 Ohm	330 Ohm	390 Ohm						
ASST. 3	5ea.	470 Ohm	560 Ohm	680 Ohm	820 Ohm	1K	1.2K	1.5K	50pcs.	$1.95
		1.8K	2.2K	2.7K						
ASST. 4	5ea.	3.3K	3.9K	4.7K	5.6K	6.8K	8.2K	10K	50pcs.	$1.95
		12K	15K	18K						
ASST. 5	5ea.	22K	27K	33K	39K	47K	56K	68K	50pcs.	$1.95
		82K	100K	120K						
ASST. 6	5ea.	150K	180K	220K	270K	330K	390K	470K	50pcs.	$1.95
		560K	680K	820K						
ASST. 7	5ea.	1M	1.2M	1.5M	1.8M	2.2M	2.7M	3.3M	50pcs.	$1.95
		3.9M	4.7M	5.6M						
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)								$10.95 ea.

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INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	22.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	28.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	9.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	11.10
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.50
8212CPA	Volt Ref/Indicator	2.50

* INTERSIL'S EVALUATION KITS

74C

74C00	.39			74C195	1.59
74C02	.39			74C221	1.95
74C04	.39			74C240	2.25
74C08	.39	74C106	.75	74C244	2.25
74C10	.39	74C107	1.89	74C373	2.49
74C14	.75	74C151	2.95	74C374	2.59
74C20	.39	74C154	3.95	74C901	.89
74C30	.39	74C157	2.25	74C903	1.15
74C42	1.39	74C160	1.69	74C911	10.95
74C48	1.95	74C161	1.60	74C912	10.95
74C73	.79	74C162	1.49	74C915	4.49
74C74	.79	74C163	1.69	74C917	10.95
74C85	1.95	74C164	1.59	74C922	5.49
74C86	.99	74C173	1.39	74C923	5.75
74C89	6.95	74C174	1.39	74C925	7.50
74C90	1.29	74C175	1.39	74C926	7.50
74C93	1.29	74C192	1.69	80C95	.79
74C95	1.59	74C193	1.69	80C97	.79

LINEAR

LH0002CN	6.85			NE570N	4.95
LM10CLH	4.50			LM702H	.79
LM11CLH	4.75			LM703CN	.89
LH0070-OH	6.05	LM340T-5	1.25	LM709N	.49
TL071CP	.79	LM340T-12	1.25	LM710N	.79
TL072CP	1.39	LM340T-15	1.25	LM711N	.79
TL074CN	2.49	LM341P-5	.75	LM723N	.69
LH0082CD	35.80	LM341P-12	.75	LM733N	1.00
TL082CP	1.19	LM341P-15	.75	LM739N	1.19
TL084CN	2.19	LM342P-5	.69	LM741CN	.35
LH0094CD	36.80	LM342P-12	.69	MC1741SCG	3.00
LM300H	.99	LM342P-15	.69	LM747N	.79
LM301CN	.35	LM348N	1.25	LM748N	.59
LM302H	1.95	LM350K	5.75	LM1014N	2.75
LM304H	1.95	LF351N	.60	LM1310N	1.95
LM305H	.99	LF353N	1.00	LM1458CN	1.49
LM307CN	.45	LF355N	1.10	LM1488N	1.25
LM308CN	1.00	LF356N	1.10	LM1489N	1.25
LM309H	1.95	LM358N	1.00	LM1496N	1.95
LM309K	1.25	LM359N	1.79	LM1556V	1.75
LM310CN	1.75	LM370N	4.49	LM1800N	2.95
LM311H	.90	LM373N	3.25	LM1877N-9	3.25
LM312H	2.49	LM377N	2.95	LM1889N	3.20
LM317MP	1.15	LM380N	1.25	LM1896N	1.75
LM317T	1.75	LM381N	1.95	LM2002T	1.49
LM317K	3.95	LM382N	1.79	LM2877P	2.05
LM318CN	1.95	LM384N	1.95	LM2878P	2.25
LM319N	1.95	LM386N-3	1.29	LM2896P-1	2.25
LM320K-5	1.35	LM387N	1.45	LM3189N	2.95
LM320K-12	1.35	LM389N	1.35	LM3900N	.69
LM320K-15	1.35	LM392N	.69	LM3905CN	1.25
LM320T-5	1.25	LF398N	4.00	LM3909N	1.15
LM320T-12	1.25	LM399H	5.00	LM3914N	3.95
LM320T-15	1.25	TL494CN	4.49	LM3915N	3.95
LM323K-5	5.95	TL496CP	1.75	LM3916N	3.95
LM324N	.99	NE510A	6.00	RC4136N	1.25
LM329DZ	.65	NE529A	4.95	RC4151NB	3.95
LM331N	3.95	NE531H	3.95	RC4194TK	5.95
LM334Z	1.30	NE536H	6.00	RC4195TK	5.49
LM335Z	1.40	NE540H	6.00	KB4428	4.25
LM336Z	1.75	NE544N	4.95	KB4429	5.95
LM337T	1.95	NE550A	1.30	LM4500A	3.25
LM337MP	1.15	NE555V	.39	ICL8038B	4.95
LM338K	6.95	LM556N	.99	LM13080N	1.29
LM339N	.99	NE564N	3.95	LM13600N	1.49
LM340K-5	1.35	LM565N	1.25	75138N	1.95
LM340K-12	1.35	LM566CN	1.95	75450N	.89
LM340K-15	1.35	LM567V	1.25	75451CN	.39

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
10 pf	.08	.06	.05	.001µF	.08	.06	.05
22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

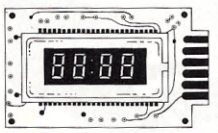
.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V

National Semiconductor Clock Modules

12VDC AUTOMOTIVE/ INSTRUMENT CLOCK



APPLICATIONS:
- In-dash autoclocks
- After-market auto/ RV clocks
- Aircraft-marine clks.
- 12VDC oper. instru.
- Portable/battery powered instrumnts.

Features: Bright 0.3" green display. Internal crystal time-base. ± 0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete – just add switches and lens.

MA1003 Module $16.95

MA1023 .7" Low Cost Digital LED Clock Module	8.95
MA1026 .7" Dig. LED Alarm Clock/Thermometer	18.95
MA5036 .3" Low Cost Digital LED Clock/Timer	6.95
MA1002 .5" LED Display Dig. Clock & Xformer	9.95

National Semiconductor RAM SALE

MM5290N-4 (MK4116/UPD416) . . $3.95 each
16K DYNAMIC RAM (250NS)
(8 EACH $29.95) (100 EACH $350.00/lot)

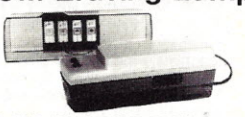
MM5290J-2 (MK4116/UPD416) . . $5.25 each
16K DYNAMIC RAM (150NS)
(8 EACH $39.95) (100 EACH $475.00/lot)

MM5298J-3A ..... $3.25 each
8K DYNAMIC RAM (LOW HALF OF MM5290J) 200NS
(8 EACH $23.95) (100 EACH $250.00/lot)

MM2114-3 ..... $5.95 each
4K STATIC RAM (300NS)
(8 EACH $43.95) (100 EACH $450.00/lot)

MM2114L-3 ..... $6.25 each
4K STATIC RAM (LOW POWER 300NS)
(8 EACH $44.95) (100 EACH $475.00/lot)

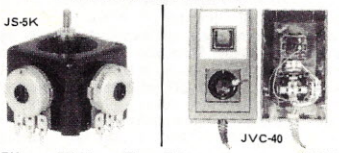
EPROM Erasing Lamp



- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact – only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11E $79.95

JOYSTICKS



JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JVC-40	40K (2) Video Controller in case	$5.95

6-Digit Clock Kit

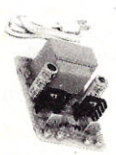


- Bright .300 ht. comm. cathode display
- Uses MM5314 clock chip
- Switches for hours, minutes and hold modes
- Hrs. easily viewable to 20 ft.
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hr. operation
- Incl. all components, case & wall transformer
- Size: 6¾" x 3-1/8" x 1¾"

JE701 ..... $19.95

NEW! JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.



FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2" w x 5-1/16" L x 2" H

JE215 Adj. Dual Power Supply Kit (as shown) . . $24.95

(Picture not shown but similar in construction to above)
JE200 Reg. Power Supply Kit (5VDC, 1 amp) . . $14.95
JE206 Adapter Brd. (to JE200) ±5,±9 & ±12V. $12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp. $19.95

MICROPROCESSOR COMPONENTS

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INS8080A	CPU	4.95
DP8212	8-Bit Input/Output	3.25
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.95
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8238	System Controller	5.95
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	7.95
DP8253	Prog. Interval Timer	14.95
DP8255	Prog. Peripheral I/O (PPI)	9.95
DP8257	Prog. DMA Control	19.95
DP8259	Prog. Interrupt Control	14.95
DP8275	Prog. CRT Controller	49.95
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MC6810API	128x8 Static RAM	4.95
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MC6828	Priority Interrupt Controller	10.95
MC6830L8	1024x8-Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.95
MC6860	0-600bps Digital MODEM	10.95
MC6862	2400bps Modulator	12.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25

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Z80A (780-1)	CPU (MK3880N-4) (4MHz)	15.95
CDP1802	CPU	19.95
2650	MPU	16.95
IDM2901ADC	CPU—4-Bit Slice (Com. Temp. Grade)	19.95
MC6502	MPU w/Clock (65K Bytes Memory)	11.95
INS8035N-6	MPU—8-Bit (6MHz)	16.95
INS8039N-6	CPU—Sgl. Chip 8-Bit (128 bytes RAM)	19.95
INS8040N-6	CPU (256 Bytes RAM)	24.95
INS8070N	CPU—64 Bytes RAM	24.95
INS8073N	CPU w/Basic Micro Interpreter	29.95
P8085	CPU	19.95
INS8900	CPU—16-Bit	29.95
TMS9900JL	MPU—16-Bit	49.95

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MM503H	Dual 50-Bit Dynamic	.50
MM506H	Dual 100-Bit Static	.50
MM512H	Dual 64-Bit Accumulator	.50
MM1402	256-Bit Dynamic	3.95
MM5013	1024-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	.89
MM5034N	Octal 80-Bit	9.95
MM5035N	Octal 89-Bit	9.95
2504V(1404A)	1024-Bit Dynamic	3.95
2518N	Hex 32-Bit Static	4.95
2522V	Dual 132-Bit Static	2.95
2524V	512-Bit Dynamic	.99
2505V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 250-Bit Static	4.00
2529V	Dual 240-Bit Static	4.00
2532N	Quad 80-Bit Static	2.95
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AF122-1CJ	Touch Tone Low Pass Filter	19.95
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LM335Z	Temperature Transducer	1.40
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MM5262	2Kx1 Dynamic	.25
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UPD414/MK4027	4K Dynamic 16-pin	4.95
TMS4044-45NL	4K Static	14.95
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TMS2716	16K EPROM (-5V, +5V, +12V)	19.95
2716Intel(2516)TI	16K EPROM (Single +5V)	10.95
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MCM66740P	128x9x7 Math Symbol & Pictures	13.50
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MICROPROCESSOR MANUALS

M-Z80	User Manual	7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

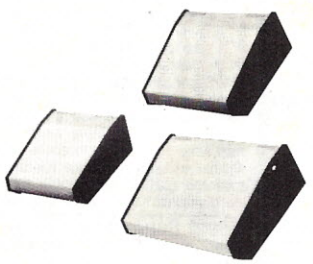
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DS0025CN	Dual MOS Clock Driver (5MZ)	3.50
DS0026CN	Dual MOS Clock Driver (5MZ)	1.95
INS1771N-1	Floppy Disc Controller	24.95
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COP470N	32-Seg.VAC Fluor. Driver (28-pin pkg.)	3.25

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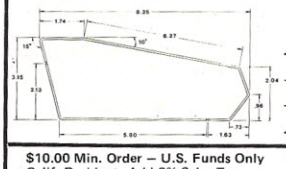
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AY-5-9500	CMOS Clock Generator	4.95
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HD0165-5	Keyboard Encoder (16 keys)	7.95
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- High strength epoxy molded end pieces in mocha brown finish.
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- Top / bottom panels .080 thk alum. Alodine type 1200 finish (gold tint color) for best paint adhesion after modification.
- Vented top and bottom panels for cooling efficiency.
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CONSTRUCTION:
The "DTE" Blank Desk Top Electronic Enclosures are designed to blend and complement today's modern computer equipment and can be used in both industrial and home. The end pieces are precision molded with an internal slot (all around) to accept both top and bottom panels. The panels are then fastened to ¼" thick tabs inside the end pieces to provide maximum rigidity to the enclosure. For ease of equipment servicing, the rear/bottom panel slides back on slotted tracks while the rest of the enclosure remains intact. Different panel widths may be used while maintaining a common profile outline. The molded end pieces can also be painted to match any panel color scheme.



Enclosure Model No.	Panel Width	PRICE
DTE-8	8.00"	$29.95
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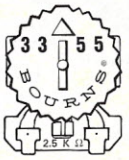
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AC1700	117V/60Hz	9 VAC 1.7 amp	$6.95
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DC 900	120V/60Hz	9 VDC 500mA	$3.95

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DB25S	D-Subminiature Socket	$3.50
DB51226	Cover for DB25P/S	$1.75
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UG89/U	BNC Jack	$3.79
UG175/U	UHF Adapter	$ .49
SO239	UHF Panel Recp.	$1.29
PL258	UHF Adapter	$1.60
PL259	UHF Plug	$1.60
UG260/U	BNC Plug	$1.79
UG1094/U	BNC Bulkhead Recp.	$1.29

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Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
★ 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
★ Documentation for Conversion

TRS-16K2 *150NS $39.95
TRS-16K4 *250NS $29.95

JE610 ASCII Encoded Keyboard Kit

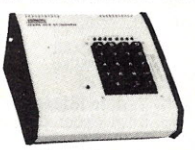


The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and –12V @ 10 mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3½"H x 14½"W x 8¾"D

JE610/DTE-AK (as pictured above) . . . $124.95
JE610 Kit 62-Key Keyboard, PC Board, & Components (no case). . . . $ 79.95
K62 62-Key Keyboard (Keyboard only) . . . $ 34.95
DTE-AK (case only – 3¾"Hx11"Wx8¾"D) $ 49.95

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY KEYBOARD



The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3½"H x 8¼"W x 8¾"D

JE600/DTE-HK (as pictured above) $99.95
JE600 Kit 19-Key Hexadec. Keyboard, PC Board & Cmpnts. (no case) . . $59.95
K19 19-Key Keyboard (Keyboard only) $14.95
DTE-HK (case only – 3½"Hx8¼"Wx8¾"D) $44.95

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7410N	.25	LM320T-12	.95	CD4035	1.00	MM5320	9.95		
7414N	.70	LM320T-15	.95	CD4040	1.35	MM5330	5.94		
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7442N	.58	LM340K-5	1.35	CD4046	1.67	4200A	9.95		
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7447N	.63	LM340K-12	1.35	CD4050	.60	91L02A	1.50		
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7450N	.25	LM340K-24	1.35	CD4060	1.42	MM57100	4.50		
7474N	.35	LM340T-5	.85	CD4066	.71	GIAY38500-1	9.95		
7475N	.49	LM340T-8	.85	CD4068	.40	MCM66751A	9.95		
7485N	.88	LM340T-12	.85	CD4069	.40	9368	3.50		
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74LS08N	.35	NE566V	1.50	74C76	1.25	Z80A	11.95		
74LS10N	.35	NE567V	1.00	74C90	1.25	8212	2.90		
74LS13N	.55	NE5708	4.75	74C93	1.25	8214	3.95		
74LS14N	1.00	78L05	.60	74C154	3.50	8216	2.90		
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74LS75N	.65			74C922	5.00	1802CP plas.	13.95		
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74LS93N	.75	8038B	4.50	74C925	7.50	1861P	9.50		
74LS95N	1.00	8700CJ	13.95	74C926	6.95	CDP1802CD	28.95		
74LS107N	.45	8701CN	22.00	74C927	6.95	CDP1802D	35.00		
74LS112N	.45	8750CJ	13.95			CDP1816P	7.95		
74LS113N	.45	LD130	9.95	**INTERFACE**					
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74LS136N	.50	ICL7103	9.50	8096	.65	AY5-1013	5.50		
74LS151N	.75	ICL7107	14.25	8097	.65	AY5-1014	7.50		
74LS155N	.79			8098	.65	3341	6.95		
74LS157N	1.10	**CMOS**		8T09	1.25				
74LS162N	1.10	CD4000	.25	8T10	4.50	**PROM**			
74LS163N	1.10	CD4001	.35	8T13	3.00	1702A	4.95		
74LS174N	1.15	CD4002	.35	8T20	5.50	2708	5.10		
74LS190N	1.25	CD4006	1.10	8T23	3.10	2716T1	18.00		
74LS221N	1.25	CD4007	.35	8T24	3.50	2716 5 Volt	10.50		
74LS258N	1.00	CD4008	1.20	8T25	3.20	8/2716 5 Volt	89.00		
74LS367N	.89	CD4009	.45	8T26	1.69	2732	29.50		
		CD4010	.45	8T28	2.75	2758	19.50		
LINEAR		CD4011	.35	8T97	1.69	8741A	55.00		
CA3045	.90	CD4012	.28	8T98	1.69	8748	55.00		
CA3046	1.10	CD4013	.47			8748-8	55.00		
CA3081	1.80	CD4014	1.25			8755A	55.00		
CA3082	1.90	CD4015	1.00	**MOS/MEMORY RAM**		N82S23	2.95		
CA3089	3.40	CD4016	.55	2101-1	3.85	N82S123	6.50		
LM301AN/AH	.35	CD4017	1.05	2102-1	.95	N82S126	3.75		
LM305H	.87	CD4018	.94	2102AL-4	1.45	N82S129	8.50		
LM307N	.35	CD4019	.45	2102AN-2L	1.65	N82S131	8.50		
LM308N	1.00	CD4020	1.02	2104A-4	4.95	N82S136	8.75		
LM309K	1.25	CD4021	1.35	2107B-4	3.75	N82S137	8.75		
LM311H/N	.90	CD4022	1.10	2111-1	3.75	DM8577	2.90		
LM317T	1.85	CD4023	.28	2112-2	3.95	8223	2.90		
LM317K	3.75	CD4024	.75	2114	3.75				
LM318	1.50	CD4025	.28	2114L 300ns	4.25				

CONNECTORS

30 pin edge	2.50
44 pin edge	2.75
86 pin edge	4.00
100 pin edge	4.50
100 pin edge WW	5.25

IC SOCKETS

Solder Tin		Low Profile	
PIN	1 UP	PIN	1UP
8	.15	22	.30
14	.14	24	.35
16	.16	28	.42
18	.27	36	.58
20	.29	40	.57

2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN		PIN	
14	.46	24	.93
16	.49	28	1.00
18	.67	40	1.59

CRYSTALS

1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
5 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 Hz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.20
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

KEYBOARD ENCODERS

AY5-2376	$12.50
AY5-3600	17.95
AY5-9100	10.50
AY5-9200	16.50
74C922	5.50
74C923	5.50
HD0165-5	6.95
AY5-9400	10.50

D Connectors RS232

DB25P	3.62
DB25S	5.20
Cover	1.67
DE9S	1.95
DA15P	2.10
DA15S	3.10
Complete Set	9.50

Hickok 3½ Digit LED multimeter 89.95
Stopwatch Kit 26.95
Auto Clock Kit 17.95
Digital Clock Kit 14.95

8K/16K Eprom Kit
(less PROMS) $89.00
Motherboard $39.00
Extender Board $15.00

RESISTORS ¼ watt 5%
10 per type .03
25 per type .025
100 per type .015
1000 per type .012
350 piece pack 29.50
5 per type 6.75
½ watt 5% per type .05

Televideo Terminal
Model 912 $785.00
Model 920 $885.00

Tiny Basic Experimentors Kit $10.00

KEYBOARDS

56 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	60.00
Fully assembled	70.00
Enclosure Plastic	14.95
Metal Enclosure	29.95

LEDS

Red T018	.15
Green, Yellow T018	.20
Jumbo Red	.20
Green, Orange, Yellow Jumbo	.25

Cliplite LED Mounting Clips 8/$1.25 (specify red, amber, green, yellow, clear)

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip.
MAX-100 8 digit Freq. Ctr. $149.95

OK WIRE WRAP TOOLS in stock
Portable Multimeter $18.00
Complete line of AP Products in stock.

SPECIAL PRODUCTS

MM5865 Stopwatch Timer with 10 pg. spec.	9.00
PC board	7.50
Switches Mom. Pushbutton	.27
3 pos. slide	.25
Encoder HD0165-5	6.95
Paratronics Model 10 Trigger Expander Kit	$229.00
Model 150 Bus Grabber Kit	$369.00
Clock Calendar Kit	**$23.95**
2.5 MHz Frequency Counter Kit	**$37.50**
30 MHz Frequency Counter Kit	**$47.75**

TRANSFORMERS

6V 300 ma	3.25
12 Volt 300 ma transformer	1.25
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.75
24V CT 100 ma	3.95
10V 1.2 amp wall plug	4.85
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
10/15 VAC 8/16 VA wall plug	9.75

DISPLAY LEDS

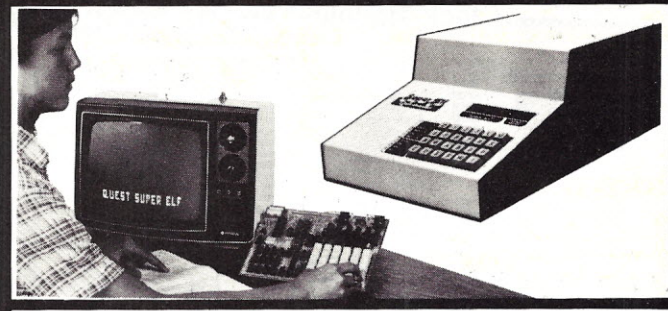
MAN1	CA	.270	2.90
MAN3	CC	.125	.39
MAN72/74	CA/CA	.300	1.00
DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.00
DL727/728	CA/CC	.500	1.90
DL747/750	CA/CC	.600	1.95
FND359	CC	.357	.70
FND500/507	CC/CA	.500	1.35
FND503/510	CC/CA	.500	.90
FND800/807	CC/CA	.800	2.20
3 digit Bubble			.60
10 digit display			1.25
7520 Clarex photocells			.39
TIL311 Hex			9.50
MAN3640	CC	.30	1.10
MAN4610	CA	.40	1.20
MAN4640	CC	.40	1.20
MAN4710	CA	.40	.95
MAN4740	CC	.40	1.20
MAN6640	CC	.56	2.95
MAN6710	CA	.60	1.35
MAN6740	CC	.60	1.35

MA1002A, C, E 8.95
MA1012A 8.95
102P3 transformer 2.25
MA1012A Transformer 2.25

DIP Switches

4-position	$ .95
5-position	1.00
6-position	1.00
7-position	1.00
8-position	1.05

Complete line of Hobby-Blox solderless breadboards in stock.
IC Starter Pack **$5.95**
Discrete Component Starter Pack **$6.57**



RCA Cosmac 1802 Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Tiny Basic Cassette **$10.00**, on ROM **$38.00**, original Elf kit board **$14.95. 1802 software;** Moews Video Graphics **$3.50.** Games and Music **$3.00**, Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes. **A 1K Super ROM Monitor $19.95** is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm.17E^{38}$), 32 bit integer ± 2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O included.

Super Basic on Cassette $55.00.

Ohio Scientific Computers

CIP Series 2 **$455.00.** Like an Apple at less than half the price! CIPMF Series 2 **$1199.00.** Minifloppy version with additional RAM/ROM. Complete software and peripherals available. Send for free brochure.

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. No high res. graphics. On board RF Modulator Kit **$4.95**

1802 16K Dynamic RAM Kit $149.00

Expandable to 32K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$63.00**

Tiny Basic Extended on Cassette $15.00
(added commands include Stringy, Array, Cassette I/O etc.) S-100 4-Slot Expansion $ 9.95
Super Monitor VI.I Source Listing $15.00

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.

Dealers: Send for excellent pricing/margin program.

Editor Assembler $25.00
(Requires minimum of 4K for E/A plus user source)
1802 Tiny Basic Source listing $19.00
Super Monitor V2.0/2.1 Source Listing $20.00

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$69.50** (with timer **$94.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00. Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$139.00**

80 IC Update Master Manual $39.00

Comp. IC data selector, 2700 pg. master reference guide. Over 51,000 cross references. Free update service through 1980. Domestic postage $3.50.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. only $17.00.

LRC 7000 + Printer $389.00

40/20 column dot matrix impact, std. paper. Interface all personal computers.

64/40/32/20 version **$405.00.** Optional cables available.

LRC 7000 printer interface cable for Super Elf with software $35.00

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.95**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. **$405.00.** 4K version **$450.00.** 4K Assembler **$85.00**, 8K Basic Interpreter **$100.00.**

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$625.00.**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$29.95.** Kit with chassis and all hardware **$43.95.** Add $4.00 shipping. Kit of hardware **$14.00.** Woodgrain case **$10.00.** $1.50 shipping.

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
$10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional.
Postage: Add 5%. C.O.D. $10.00 min. order.

FREE: Send for your copy of our NEW 1980 QUEST CATALOG. Include 48¢ stamp.

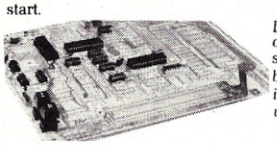
Start learning and computing for only ***$129.95*** *with a Netronics 8085-based computer kit. Then expand it in low-cost steps to a business/development system with 64k or more RAM, 8" floppy disk drives, hard disks and multi-terminal I/O.*

THE NEW EXPLORER/85 SYSTEM

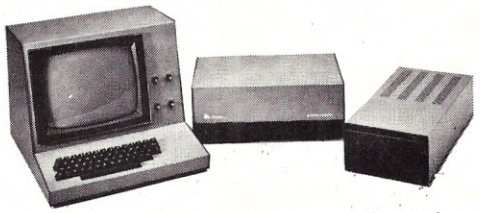
Special! *Full 8" floppy, 64k system for less than the price of a mini! Only* **$1499.95!**

(Also available wired & tested, $1799.95)

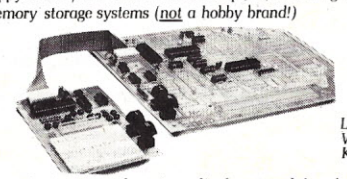
Imagine — for only $129.95 you can own the starting level of Explorer/85, a computer that's expandable into full business/development capabilities — a computer that can be your beginner system, an OEM controller, or an IBM-formatted 8" disk small business system. From the first day you own Explorer/85, you begin computing on a significant level, and applying principles discussed in leading computer magazines. Explorer/85 features the advanced Intel 8085 cpu, which is 100% compatible with the older 8080A. It offers onboard S-100 bus expansion, Microsoft BASIC in ROM, plus instant conversion to mass storage disk memory with standard IBM-formatted 8" disks. All for only $129.95, plus the cost of power supply, keyboard/terminal and RF modulator if you don't have them (see our remarkable prices below for these and other accessories). With a Hex Keypad/display front panel, Level "A" can be programmed with no need for a terminal, ideal for a controller, OEM, or a real low-cost start.



Level "A" is a complete operating system, perfect for beginners, hobbyists, industrial controller use. $129.95



Full 8" disk system for less than the price of a mini (shown with Netronics Explorer/85 computer and new terminal). System features floppy drive from Control Data Corp., world's largest maker of memory storage systems (not a hobby brand!)



Level "A" With Hex Keypad/Display.

LEVEL "A" SPECIFICATIONS

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an advanced 8155 RAM I/O . . . all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

PC Board: Glass epoxy, plated through holes with solder mask. • **I/O:** Provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader . . . cassette tape recorder input and output . . . cassette tape control output . . . LED output indicator on SOD (serial output) line . . . printer interface (less drivers) . . . total of four 8-bit plus one 6-bit I/O ports. • **Crystal Frequency:** 6.144 MHz. • **Control Switches:** Reset and user (RST 7.5) interrupt . . . additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard. • **Counter/Timer:** Programmable, 14-bit binary. • **System RAM:** 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems . . . RAM expandable to 64K via S-100 bus or 4k on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F000, leaving 0000 free for user RAM/ROM. Features include tape load with labeling . . . examine/change contents of memory . . . insert data . . . warm start . . . examine and change all registers . . . single step with register display at each break point, a debugging/training feature . . . go to execution address . . . move blocks of memory from one location to another . . . fill blocks of memory with a constant . . . display blocks of memory . . . automatic baud rate selection to 9600 baud . . . variable display line length control (1-255 characters/line) . . . channelized I/O monitor routine with 8-bit parallel output for high-speed printer . . . serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Keypad/Display Version): Tape load with labeling . . . tape dump with labeling . . . examine/change contents of memory . . . insert data . . . warm start . . . examine and change all registers . . . single step with register display at each break point . . . go to execution address. Level "A" in this version makes a perfect controller for industrial applications, and is programmed using the Netronics Hex Keypad/Display. It is low cost, perfect for beginners.

HEX KEYPAD/DISPLAY SPECIFICATIONS

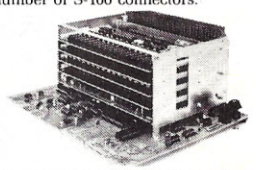
Calculator type keypad with 24 system-defined and 16 user-defined keys. Six digit calculator-type display, that displays full address plus data as well as register and status information.

LEVEL "B" SPECIFICATIONS

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards, and includes: address decoding for onboard 4k RAM expansion selectable in 4k blocks . . . address decoding for onboard 8k EPROM expansion selectable in 8k blocks . . . address and data bus drivers for onboard expansion . . . wait state generator (jumper selectable), to allow the use of slower memories . . . two separate 5 volt regulators.

LEVEL "C" SPECIFICATIONS

Level "C" expands Explorer/85's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and card are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card, gold plated S-100 extension PC board that plugs into the motherboard. Just add required number of S-100 connectors.



Explorer/85 With Level "C" Card Cage.

LEVEL "D" SPECIFICATIONS

Level "D" provides 4k of RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

LEVEL "E" SPECIFICATIONS

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for 2k x 8 RAM IC's (allowing for up to 12k of onboard RAM).

DISK DRIVE SPECIFICATIONS

- 8" CONTROL DATA CORP. professional drive.
- LSI controller.
- Write protect.
- Single or double density.
- Data capacity: 401,016 bytes (SD), 802,032 bytes (DD), unformatted.
- Access time: 25ms (one track).

DISK CONTROLLER/ I/O BOARD SPECIFICATIONS

- Controls up to four 8" drives.
- 1771A LSI (SD) floppy disk controller.
- Onboard data separator (IBM compatible).
- 2 Serial I/O ports
- Autoboot to disk system when system reset.
- 2716 PROM socket included for use in custom applications.
- Onboard crystal controlled.
- Onboard I/O baud rate generators to 9600 baud.
- Double-sided PC board (glass epoxy.)

DISK DRIVE CABINET/POWER SUPPLY

- Deluxe steel cabinet with individual power supply for maximum reliability and stability.

ORDER A COORDINATED EXPLORER/85 APPLICATIONS PAK!

Beginner's Pak (Save $26.00!) — Buy Level "A" (Terminal Version) with Monitor Source Listing and AP-1 5-amp Power Supply: (regular price $199.95), now at SPECIAL PRICE: **$169.95** plus post. & insur.

Experimenter's Pak II (Save $53.40!) — Buy Level "A" (Hex Keypad/Display Version) with Hex Keypad/Display, Intel 8085 User Manual, Level "A" Hex Monitor Source Listing, and AP-1 5-amp Power Supply: (regular price $279.35), all at SPECIAL PRICE: **$219.95** plus post. & insur.

Special Microsoft BASIC Pak (Save $103.00!) — Includes Level "A" (Terminal Version), Level "B", Level "D" (4k RAM), Level "E", 8k Microsoft in ROM, Intel 8085 User Manual, Level "A" Monitor Source Listing, and AP-1 5-amp Power Supply: (regular price $439.70), now yours at SPECIAL PRICE: **$329.95** plus post. & insur.

ADD A TERMINAL WITH CABINET, GET A FREE RF MODULATOR: Save over $114 at this SPECIAL PRICE: **$499.95** plus post. & insur.

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- ☐ **8k Microsoft BASIC** on cassette tape. **$64.95** postpaid.
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- ☐ **64k RAM kit** . . . **$499.95** plus $2 post. & insur.
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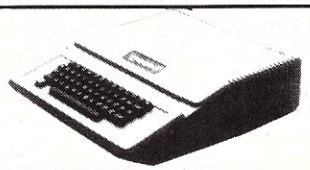
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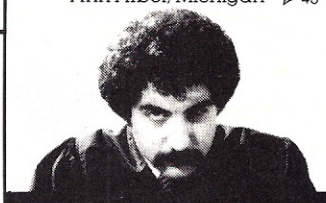


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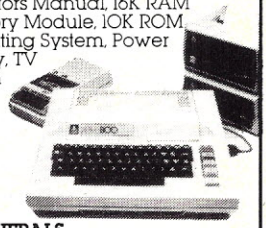
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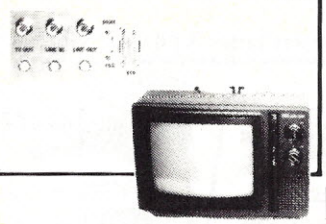
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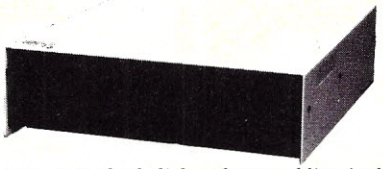
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16K RAM Card - Microsoft

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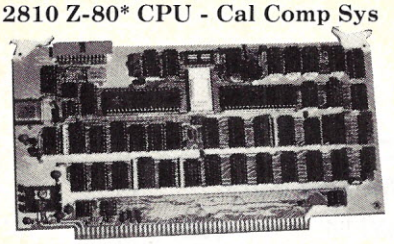
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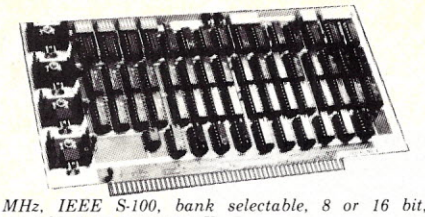
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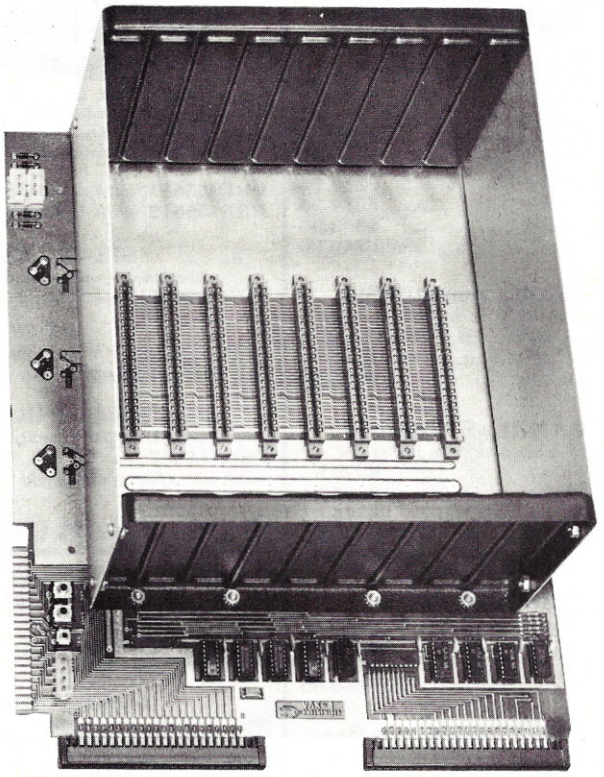
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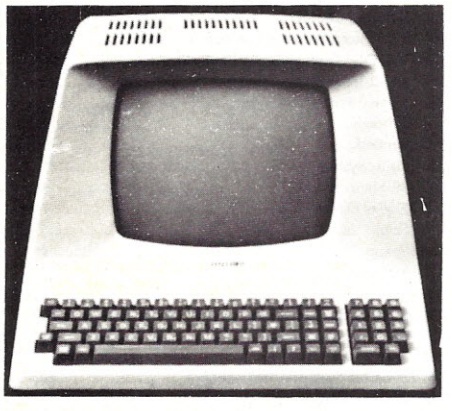


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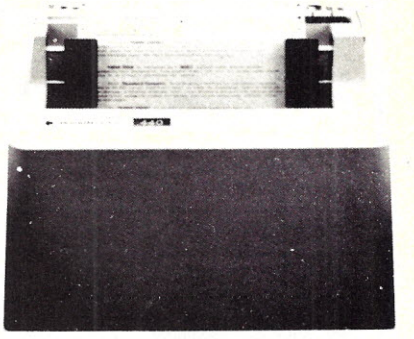
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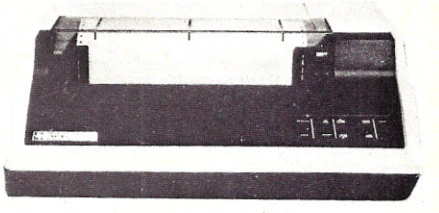


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LETTERS

(From page 29)

Aires alone) that are as reputable as any that can be found in the United States. To be specific, I own a company that has proven to be the first successful Radio Shack dealer in Argentina, and have been in business since July 1979.

In our last fiscal year we marketed over $1 million of computers and software, at prices competitive with those found in the United States after paying legal taxes and duties imposed by the Argentine government. As an instance, I quote some prices of the equipment available in Buenos Aries in my store: A model I TRS-80, Level II, 16K unit sells for $2000 (US), with other models similarly priced. Further, you will find that all other dealers charge the same price, and, in fact, that Radio Shack published a Spanish catalogue without prices because of various tariffs and duties imposed by different governments.

I feel that this kind of article will not promote the type of relations that should exist between our nations and our businessmen that must work together. My feelings are that your article will cause hard feelings with people such as the regional manager for Latin America, who is doing excellent work establishing good reliable dealers for the Tandy Corporation.

Dr. Francisco E. Montagut
Montagut Computadoras
Buenos Aires, Argentina

Thank you for your update on the microcomputing situation in Buenos Aires. It was certainly not the article's intention to question the reputation or efforts of Radio Shack computer dealers in Argentina or the Tandy Corporation. We apologize if any "hard feelings" were caused by the publication of the article. —Editors.

Marketing Dilettantes

I agree with your editorial on the coming Japanese invasion ("The Asian Threat," p. 6, January 1981). It has been most interesting as a newcomer to the digital side of electronics to see the same marketing mistakes being made by the wunderkind digital whiz kids. What a damn shame.

I have encountered two kinds of computer store operators. First, the hardware freak. His place has multi-megabyte speech recognizing electronic J.S. Bach and 3-D graphic manipulating holo-projectors. But he can't sell me a dumb-dumb inventory program for my small business. Not in stock right now—or ever, I suspect.

Then there's the guy who was selling used cars last week. He read some magazines and now he's selling computers to beat the band. Funny how when you sit down with him so he can demonstrate some big-ticket software—like a word processor—he never seems to be able to make it work just right. Must be something in the way the 80-column board interacts with the control characters in the word blender. But you can see from the nice padded documentation binder just how it *will* work—after you fork over $500 and get it home. Maybe.

In any new market there will be great pressure from the nuts who have to be at the leading edge. And as long as the market is voracious and uninformed—before taste develops—these guys will do well. The hardware freak will never realize, like George Eastman did, that Kodak sold more film than cameras. The dilettante peddler will be satisfied with the sales to people even less knowledgeable than himself.

The Japs do their homework. That's why they'll kill us. Just ask McIntosh audio—or Chrysler.

William J. Barrett
Ridgefield, CT

Floppy Thinking

Your recent article on Etymological Gymnastics ("As the Word Turns," March 1981, p. 24) has given us a peek at what may be the basic surge of the future. It rammed my memory to give me enough drive to string out these statements. A pet theory of mine that I like to put forth is that new expressions often pop out in technical use and later become enscrolled in the menu of daily language. It's something we should monitor, if you understand my floppy thinking.

If it's any console, you deserve an apple and a buss for poking me into this.

Bruce Sloane
Penacook, NH

That's easy for you to say.—Editors.

A Merry Micro Christmas

I found the Kilobaud Klassroom series project a very useful piece of experience. It took me four tries to get it going—at first it pulled the power supply voltage too low, then I had to struggle a bit with the addressing.

I found the discussion on address decoding a bit exiguous; I don't think I could have handled it without a bit of help from a local expert. The section on logic analyzers was much too general to be of use; it could have been left out. I'd like to see more on the use of A/D converters and look-up tables.

I got the 6802 board debugged and running just before Christmas, and the experience was the best Christmas present I've had in a while.

Sylvester O'Farrell
Ottawa, Ontario

No More Waiting

The program "Auto-Menu for the Apple II" (March 1981, p. 68) causes the Apple to pause if the screen fills up with "catalog" and wait for a key to be pressed. Listing 1 will allow the program to run and display the last 22 catalog items regardless of the number of files on the disk without requiring a key to be pressed. The same changes will work for the Applesoft version, permitting turnkey operation with an Apple II Plus.

Philip L. Bryan
Park City, IL

```
10 D$ = " ": TEXT : CALL -936
11 POKE 56, 240: POKE 57,2: POKE
   752,169
12 POKE 753,64: POKE 754,96:
   CALL 1002
13 PRINT D$; "CATALOG"
14 POKE 56,27: POKE 57,253: CALL
   1002
```

Listing 1.

Johnny-on-the-Spot

In the March 1981 issue of *Microcomputing* ("Built-in Computer Serviceman," p.6), you suggest that "it will be possible for a system of remote diagnostics to be designed which can be done over the phone line via a modem." The Digital Equipment Corporation has incorporated this type of testing into their field service contracts, especially for the VAX 11/780 and VAX 11/750 machines. The "built-in computer serviceman" concept is one that DEC realized would save a customer a lot of down time and money. This also allows the field service rep to bring in the proper module or software to correct the problem right on the spot. The response time is improved, and therefore the down time is minimal.

Jay D. Miller, III
Albuquerque, NM

MICRO QUIZ

(From page 18)

Answer: 3
Every other element is ignored. X(5) = 25; X(4) = 16; X(4) = 16; X(8) = 64.

Edited by Linda Stephenson

Vector Desk-Top Computer
Percom Motherboards
General-Purpose Controller Board
64K Superbrain

Vector Hard Disk Computer

The Vector 3005 desk-top business data and word processing system, incorporating the speed, capacity and reliability of Winchester hard disk storage, has been introduced by Vector Graphics, Inc., 31364 Via Colinas, Westlake Village, CA 91362.

It includes a 5-1/4-inch 5 Mbyte Winchester, a 630K double-sided, quad-density floppy disk, a Vector three-display terminal and keyboard, and Vector software. The disk stores a file of up to five Mbyte or 256 different files, about twice the capacity of the Vector 2800. A single hard disk can store a mailing list of up to 3700 names and addresses.

A Dualmode controller board with automatic error-correcting capability controls both the Winchester and the floppy disk drives. Track-to-track access time of the Winchester and companion floppy disks is three ms; both the Winchester and floppy drives are housed in a compact unit which fits on a desk top adjacent to the 3005's display terminal. The Vector 3005 costs $7950. Reader Service number 498.

Three New Motherboards for 680X Systems

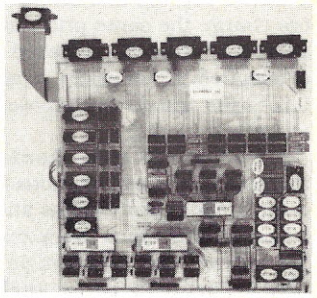
Percom Data Company, 211 N. Kirby, Garland, TX 75042, is offering three new motherboards for 680X systems: an extendable, seven-slot System-50 (SS-50) board that can be used either as a system bus or as an extender card for troubleshooting, $29.95; an extendable, five-slot EX-86 bus (EXORciser bus) motherboard, $79.95; and an eight-slot SS-30 bus I/O motherboard that can be used to extend either the System-50 or EX-86 motherboard, $44.95.

In addition to being self-extendable, the System-50 and EX-86 motherboards can be used to extend each other. This allows system designers to use both System-50 and EX-86 function cards in the same system. The system can also be expanded with the 30-pin I/O motherboard. Reader Service number 495.

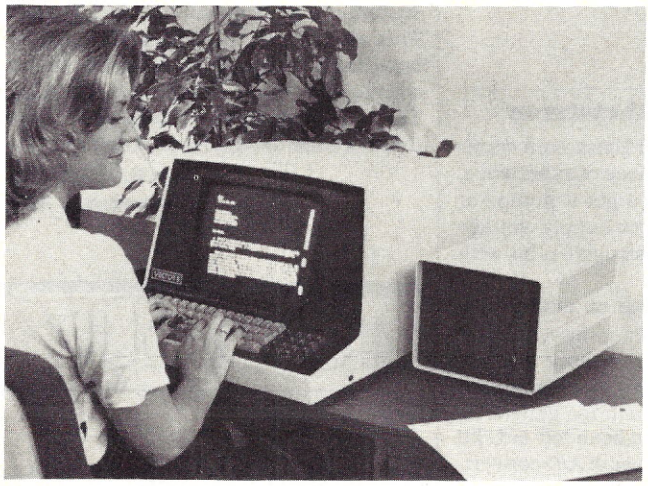
General-Purpose Controller Board

The General Purpose Controller Board is a self-contained microcomputer with CPU, ROM, RAM and I/O. It was designed for general purpose, but is ideally suited for communications applications. The board contains five USARTs (RS-232 interface), one PPI (for IEEE 488 interface), 12K of EPROM, 8085 CPU, 256×4 PROM, 4K of static RAM, 16 DPDT miniature relays, one interrupt controller, 68 I/O ports and space for additional breadboards.

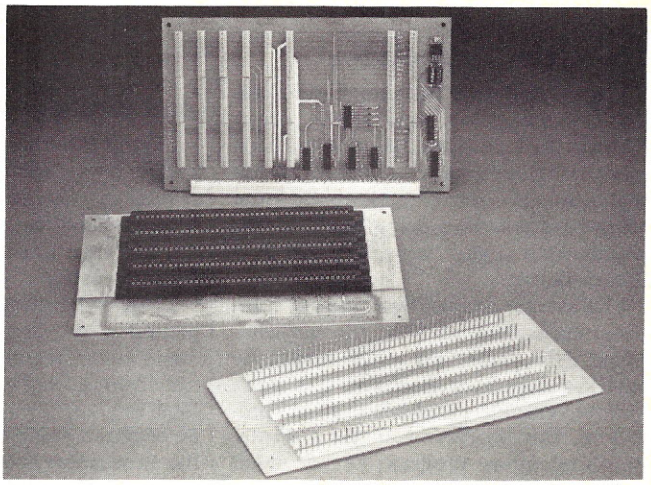
The board is available in kit form for $599. The assembled and tested version is priced at $899. Documentation and sample software routines are included.



Giltronix's controller board.



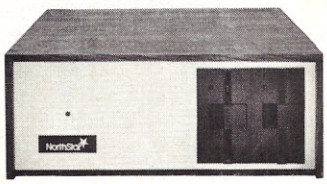
Vector Graphic's desk-top computer with Winchester disk.



Percom's new motherboards.

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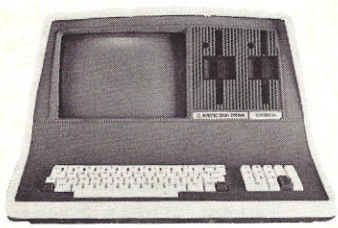
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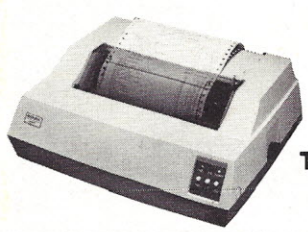


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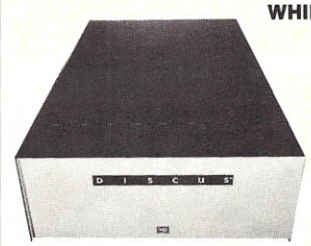
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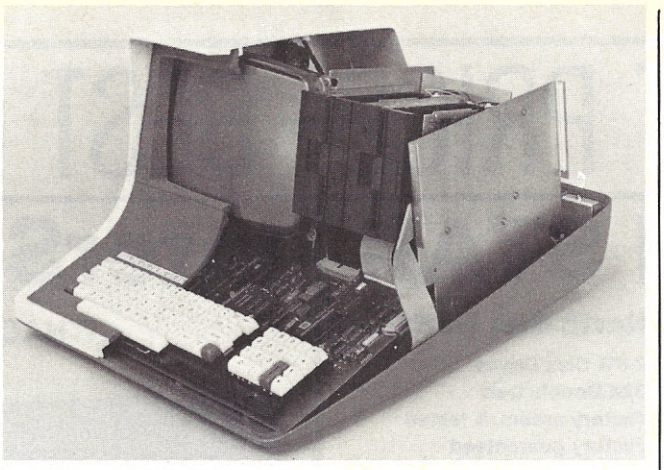
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Giltronix, Inc., 450 San Antonio Ave., Palo Alto, CA 94306. Reader Service number 499.

New Superbrain

The new Superbrain microcomputer features a standard 64K of RAM. The basic model contained only 32K, but the new model contains the extra 32K installed during the manufacturing process, so it is fully tested and burned in before it leaves the plant. This eliminates the possibility of installation error. The new 64K model costs $3495.

Intertec Data Systems, 2300 Broad River Road, Columbia, SC 29210. Reader Service number 488.



A cutaway view of the 64K Superbrain showing disk drives, CRT screen and keyboard/CPU module.

TRS-80 Upgrade

Developmate 81 is a compact add-on device designed to upgrade any size TRS-80 Model I into a full development system. It adds both Z-80 in-circuit-emulation and EPROM/EEPROM programming capability, and simply plugs into the expansion connector of the TRS-80. The PROM programmer has a universal personality module which defines the voltages and connections to the PROM so that future devices with up to 28 pins can be accommodated. Software for programming and verifying different PROM types is included. The price for the Developmate 81 is $329.

Orion Instruments, 172 Otis Ave., Woodside, CA 94062. Reader Service number 487.



The Developmate 81 upgrade for the TRS-80.

Okidata Printer

The Okidata Microline-80 printer is now being offered by Access Unlimited, 315 N. Shiloh, Garland, TX 75042. The Microline-80 is a desktop, serial impact dot-matrix printer featuring expanded character and graphics capability. It accepts standard roll paper, fan-fold forms or individual sheets. It prints 40, 80 or 132 characters per line and 96 ASCII characters (9×6 dot), 64 graphics characters (6×12 dot) and Katakana characters.

Throughput is 80 characters per second (standard character width). The printhead life is rated at 200 million characters. The printer, including removable roll-paper stand, is priced at $495. Reader Service number 483.

Heath/Zenith-89 370K Mini Drive

Minifloppy drives with 370K of usable file space are now available for use on the Heath/Zenith-89 computer, enabling the all-in-one computer to run CP/M with 5-1/4 inch double-sided, double-track density formats and hard disks using sealed technology or removable media.

Tandon TM100-4 drives are available from Magnolia Microsystems, 2812 Thorndyke Ave. West, Seattle, WA 98199. They can be mounted in the H/Z-89 chassis, or as add-ons, encased singly or in pairs. The 5-1/4 inch drive holds 120K more than an eight-inch



The Okidata Microline-80 printer.

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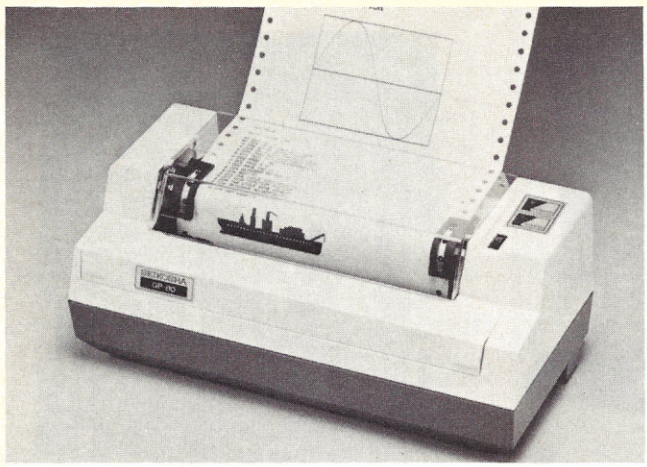


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The GP-80M printer from Axiom.

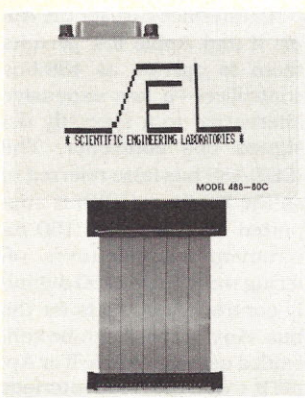
single-sided, single-density drive, while occupying half the space. For those with larger file requirements, Magnolia Microsystems also supports Remex double-sided, double-density (one Mbyte) eight-inch drives, Corvus ten or 20 Mbyte Winchester drives, and Western Dynex Series 6000 drives using five Mbytes of fixed storage and five Mbytes in a removable cartridge (using the Cameo controller).

All these drives—in any combination—may be addressed by a single H/Z-89 or by multiple H/Z-89s with appropriate interface boards and CP/M in each. Reader Service number 490.

TRS-80 Controller Interface Adaptor

Scientific Engineering Laboratories, 11 Neil Drive, Old Bethpage, NY 11804, has a new device for interfacing the GPIB-488 to the TRS-80 Model III computer. Model 488-80C enables any TRS-80 Model III with 16K RAM and Level 2 BASIC to be used as a GPIB-488 controller with GPIB IO in BASIC. A machine-level driver program provided with the Model 488-80C, on tape or disk, interacts with Level 2 BASIC or disk BASIC.

An optional relocatable machine-level driver program, part number ML3, is now available for assembler-level GPIB I/O programming. The price for Model 488-80C is $225. The ML3 is $35. Reader Service number 489.



SEL's interface adaptor for the TRS-80.

Seikosha GP-80M Printer

A new impact printer, which uses a single print hammer instead of the seven or more individual solenoids and print wires found in conventional dot-matrix printers, is now available from the Axiom Corp., 1014 Griswold Ave., San Fernando, CA 91340. The Seikosha GP-80M, which prints both graphics and alphanumerics, employs a rotating platen with protruding splines positioned behind the paper. The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper in front of the rotating platen. A precision gear train assures the exact positioning of the print hammer relative to the splines on the platen.

Standard features of the GP-80M include ASCII uppercase and lowercase character sets, up to 80 columns with 12

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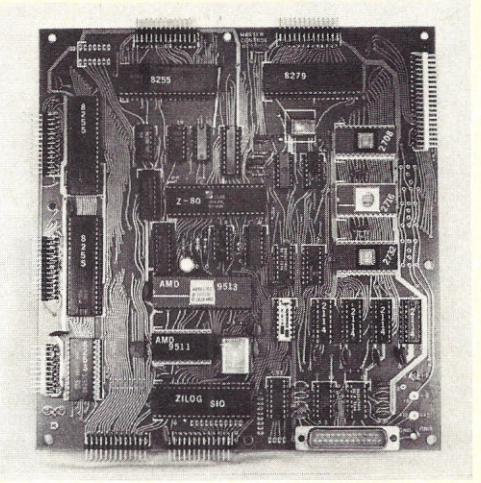
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Digital Cassettes

Micro-80, Inc., K-2665 North Busby Road, Oak Harbor, WA 98277, has recently introduced a line of digital cassettes that feature high-quality magnetic tape for 100 percent error-free recording. No more tape dropouts or no-loads.

The high-impact styrene cassette shells are of five-screw construction and conform to IEC-94 standards to maintain close tolerances for optimum tape-to-head alignment and control. The cassettes are suitable for commercial duplication and other professional applications. Reader Service number 492.

Computer Cases

The Computer Case Company, 5650 Indian Mound Court, Columbus, OH 43213, has added five new cases to their line of Comp-cases for microcomputers and related equipment. They include the AP104, for the Apple III, which holds the computer, two additional disk drives and a Silentype printer, and sells for $139; the AP105, for a monitor such as the Sanyo or Leedx 13 inch, which is $99; the RS204, for the TRS-80 Model III, selling for $129; the RS205, for the Radio Shack Color Computer, $99; and the P403, for the Epson MX80 and MX70 printers, also $99.

The cases provide portability and safe storage. A key lock protects your computer and software from tampering and unauthorized use. Cords can exit the case with the top on and locked, to provide convenient security without the need to disconnect electrical cords and cables. The tops are removable so the equipment can be operated without removal from the case. Reader Service number 485.

Master Controller Board

The Master Controller Board (MCB) is a Z-80-powered single-board computer, useful in situations where a dedicated microprocessor can perform a control or computing function. The MCB is customized for each application by inserting RAM, ROM/EPROM and control chips on the board as needed. All I/O chips are memory-mapped and I/O-mapped. Three ROM/EPROM sockets are provided for up to 12K of ROM/EPROM in various configurations. Two kilobytes of RAM are available. Up to three 8255s can be installed, giving 72 lines of parallel I/O. The parallel ports are programmable as input or output ports in four- and eight-bit increments. The chips can also be used in a handshaking and/or bidirectional mode.

The Master Controller Board can also incorporate the 8279 keyboard controller, Z-80 SIO chip providing two serial I/O ports, 8253 and 9513 counter/timers, a high-speed arithmetic chip and an expansion connector. The bare board is $49.95.

R. W. Electronics, 3165 North Clybourn, Chicago, IL 60618. Reader Service number 486.

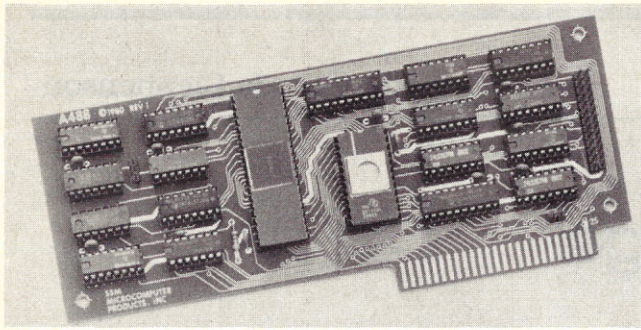


Micro-80 cassettes.

Apple 488 Interface Card

An interface card for the Apple II and Apple II+ permits them to operate as 488-bus controllers—a less expensive alternative to a specially designed bus controller. The IEEE-488 bus (also referred to as the HP-IB or GPIB) is supported by more than 150 instrument manufacturers, offering more than 1200 digitally-controlled products for the bus. Any of these can be controlled using an Apple II or Apple II+ and the A488 interface card.

Simple instrument string commands are used to control



SSM's 488 controller card for the Apple.

the bus and system. Equipment on the bus can be designated by a name of from one to 16 characters. Up to 15 pieces of equipment can be connected to the A488 across a transmission distance of up to 66 feet from the Apple.

Required user-programming is minimal. The A488 is supplied with a six-foot cable and connectors, and full documentation. The price is $475.

SSM Microcomputer Products, Inc., 2190 Paragon Drive, San Jose, CA 95131. Reader Service number 491.

Phonetic Speech Kit

A phonetic voice synthesizer in the form of a sample evaluation kit is now available to system designers who wish to incorporate unlimited speech capability into their products or services. The Votrax Speech PAC (phoneme access controller) is a small self-contained circuit board consisting of a unique CMOS silicon speech chip, external controller, memory and on-board audio amplifier. The unit comes preprogrammed with 250 stored words and phrases which can be intermixed with phoneme sequences to provide unlimited vocabulary.

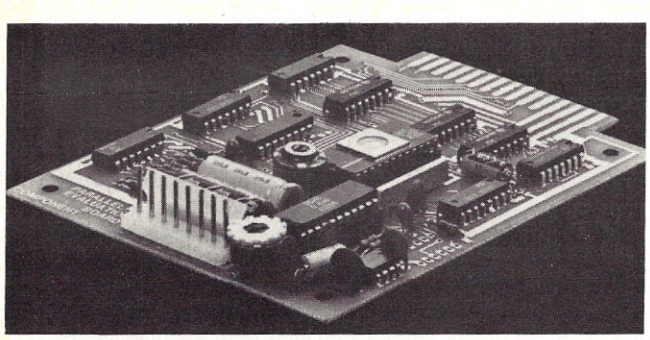
Speech PAC is designed for use in evaluating the potential for phonetic speech synthesis in a variety of low-budget, low-volume product design systems, including home computers, appliances, electronic toys and games, alarm systems and calculators. As users become familiar with phonetic programming and synthesized speech quality, they can reconfigure and expand their own phoneme-based vocabularies. The units are priced at $275.

Vodex Division, Votrax, 500 Stephenson Highway, Troy, MI 48081. Reader Service number 494.

Memory Boards for The Atari 400/800

The AT-16, a 16K 200 ns board, and the AT-32, a 32K 200 ns board, are now available for use with the Atari 400/800 microcomputers. The memory boards are designed to be completely compatible with all existing hardware and software, and are user-installable with no modifications. The AT-16 board costs $119.50, and the AT-32 is $199.50.

Microtek Peripherals Corporation, 9514 Chesapeake Drive, San Diego, CA 92123. Reader Service number 493.



The Votrax Speech PAC.

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Edited by Linda Stephenson

Financial Planner
6809 Sort/Merge Package
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Financial Planning Package

A comprehensive software package for executives and organizational planners is being offered by Lifeboat Associates, 1651 Third Ave., New York, NY 10028. FPL (Financial Planning Language) is designed for analysis of complex economic questions. Possible applications include profit and loss forecasts, operating reports involving consolidations, commercial loan evaluations, pro forma statements, product line planning, budget planning and consolidation. It will handle product evaluation, cash flow management, real estate acquisition and development analysis, acquisition or merger analysis, marketing plans and performance, material and labor requirements and capital investment analysis.

Once a financial model is set up on FPL, the user can update forecasts, explore alternatives and consolidate or recalculate data. Changes such as labor demands, rising interest rates and economic factors affecting sales can be incorporated. FPL costs $695. Reader Service number 476.

UniFLEX Sort/Merge Package

Technical Systems Consultants, Inc., PO Box 2570, West Lafayette, IN 47906, now offers a full disk sort/merge package for operation with the 6809 UniFLEX operating system. Written in 6809 assembler language, the package features a convenient operator interface and very fast sorts. Any size and type file can be sorted, with parameters for the sort supplied as part of the command line, through use of a parameter editor or in an existing parameter file. The package sorts files of any size by breaking them into multiple temporary files, which are then individually sorted and merged. It also performs merges on previously sorted files. Both input and output can be routed to most devices.

The program features handling of fixed or variable length input records and fields, up to 20 input or output keys and key length of up to 250 characters. It supports ascending and descending and right- or left-justified keys, user-definable sorting sequence, run-time messages and a record select/exclude feature. The price is $100, with maintenance available for $50 annually. Reader Service number 477.



Kevin O'Connell, controller of Lifeboat Associates, demonstrates the Financial Planning Language.

SCRIPSIT Expansion

FLEXTEXT is a new software product that merges your SCRIPSIT word processing system with the capabilities of your Centronics 737 printer. It lets you design a document with any combination of proportional character set (in normal and extended modes), right justified formatting, underlining, subscripts and superscripts.

FLEXTEXT requires at least one disk drive and a TRSDOS-type operating system (preferably NEWDOS/80 with its MINI DOS feature, allowing DIR and other DOS commands while the resident SCRIPSIT file remains undisturbed). It is available from Apparat, Inc., 4401 South Tamarac, Denver, CO 80237, for $29.95. Reader Service number 467.

Business Forecasting

Trend-Spotter is a business graphics and forecasting analysis package for the Apple II + computer. It provides the ability to spot emerging trends through quick manipulation and graphing of business data. Trend-Spotter will generate color graphics displays, calculate trend lines, perform mathematical and statistical computations, print graphic and tabular data and edit and update data.

The package includes the Trend-Spotter diskette, owner's manual and owner warranty card, and costs $275.

Software Resources, Inc., 44 Brattle St., Cambridge, MA 02138. Reader Service number 475.

Dental Office Manager

Dentisaid, a dental office management software package, has been upgraded to include many user oriented enhancements and will now operate on most Z-80-based and Apple II computers. It automatically prints standard ADA insurance form, prequalification and actual services; monthly statements; patient recall notices; accounts receivable aging reports; a daily summary of work performed and payments received; daily, weekly, monthly and yearly

totals; production analysis using standard ADA categories; and a display of individual accounts.

Micro Computer Management, Inc., 200 West Prospect Road, Fort Collins, CO 80526. Reader Service number 481.

Atari Chess and Checkers

Personal Software, Inc., 1330 Bordeaux Drive, Sunnyvale, CA 94086, has introduced MicroChess and Checker King cassettes for the Atari 400 and 800 personal computers.

MicroChess has eight levels of play, and lets the player pick the appropriate ability level. It plays by tournament rules and allows no illegal moves, making the program an excellent chess teacher.

Checker King turns the computer display screen into a colorful checkerboard, where all pieces are—like MicroChess—illustrated using high-resolution graphics. It allows single, double and triple jumps, forces jumps and performs according to the tournament rules of checkers at all eight levels of play.

An on-screen, real-time clock ticks off the seconds while the player and the computer ponder the next move. Reader Service number 466.

Smart Terminal Programs for TRS-80 Model III

SMARTIII is a smart terminal program written for the TRS-80 Model III, available on a 1500 baud cassette or double-density disk. It permits transfer of BASIC programs between the host computer and the cassette or disk storage device, thus allowing off-line text preparation with Electric Pencil or SCRIPSIT for on-line transmission. FILE permits generation and storage of text, then transmission by SMARTIII for those who do not have word processors.

SMARTIII also permits transfer of source code files. The recipient can create the object code using an editor/assembler program. A separate command is available for transferring object (hexadecimal) code files. Other features are included. SMARTIII can be used with any RS-232-compatible modem. It is supplied in a protective binder with full operating instructions, and the price is $99.50.

The MicroPeripheral Corp., 2643 151st Place, N.E., Redmond, WA 98052. Reader Service number 468.

TRS-80 Utilities

Racet Computes, 1330 N. Glassell, Suite M, Orange, CA 92667, has introduced three programs for your TRS-80. DISCAT is a comprehensive diskette cataloging/indexing utility that will give you access to any indexed program in less than three seconds. It operates with TRSDOS, NEWDOS+ and NEWDOS80 operating systems. The price is $50 for either the Model I or Model III configuration.

The KFS-80 ISAM package permits rapid insertion of, and access to, keyed records in one or more data files. It provides the application programmer with a disk handling facility for development of database applications. Utility routines are included for file maintenance. It is available for $100 for Model I and III, and $175 for Model II.

LPSPOOL permits concurrent printing and processing, thereby speeding computer throughput. Multiple copies of output can be produced automatically without user program changes. Output may be held until a more convenient time for printing, or deleted if not required. The utility was written for the TRS-80 Model I, and supports parallel or serial printers. The price is $75. Reader Service number 469.

Pascal Programming Tools

Three new software tools for Pascal programmers are currently being offered. They are designed to simplify many common I/O programming tasks.

Screen Handler is compatible with a variety of terminals, and simplifies CRT data input. A system for storing and changing user prompts without reprogramming is provid-

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LINE PRINTER V $1616
160cps. Designed for heavy business use. Bidirectional, 7x9 matrix.

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CHAINBLD/BAS—A super chaining file creation editor & assembler for NEWDOS80. Very fast, easy to use. Reads and edits existing files.
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The Electric Pencil from Michael Shrayer	$150.00
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ed, as well as an error checking feature. The price for this program is $75.

Output Formatter aids in designing and programming reports. It includes tab function, automatic page and line counter during program execution and top-of-form routine. The price is $37.

A package which includes Output Formatter and additional software is also available. It allows an end user to redesign reports without programming. Forms Generator costs $49.50.

Source code for these tools is available on Apple or eight-inch diskettes, in either UCSD Pascal or Pascal/M. Documentation is included.

HDP, Inc., 222 E. Anapamu St., Santa Barbara, CA 93101. Reader Service number 471.

FORTH for the TRS-80

TFORTH, a FIG-standard version of FORTH extended for the TRS-80, is now available from Sirius Systems, 7528 Oak Ridge Highway, Knoxville, TN 37921. TFORTH contains a built-in operating system, assembler, text editor, floating-point math package, I/O package and phoneme assembler. It is supplied on 5-1/4-inch floppy diskette for $130. Reader Service number 479.

Educational Programs for Basic Living Skills

A new series of educational programs designed for special needs audiences is available from Interpretive Education, 2306 Winters Drive, Kalamazoo, MI 49002. The programs automatically individualize content by branching to the learner's own reading and comprehension levels.

The series currently includes Poison Proof Your Home, Income Meets Expenses, You Can Bank on It, Home Safe Home, Money Management Assessment Series and Job Readiness Assessment and Development. The programs are written for the Apple II with 48K and disk drive, and the TRS-80 Model I, Level II, with 16K and cassette drive. They contain from four to eight diskettes or cassettes, and range in price from $125 to $340 per program. Reader Service number 474.

TRS-80 Plot-80

Plot-80 for the TRS-80 Model I plots graphs and histograms of various types with numbered and labeled axes. Any type of image utilizing lines and points is possible using one of five possible modes. Any number of plot modes may be superimposed on the same image. It requires 48K RAM, one disk drive and a graphics printer such as Base-2, Paper Tiger, Gencom, Qume, Xerox, Diablo or NEC Spinwriter. Price is $99.95.

Microcomputer Specialists, PO Box 11295, Elkins Park, PA 19117. Reader Service number 478.

Personnel Analyzer

The Leadership Analysis program can help managers spot personnel character traits, including areas of potential leadership and areas of possible conflict, to establish more productive management teams and to better avoid situations creating conflict between personnel. The program administers a complete battery of exercises, performs the analysis and prints a personalized report complete with graphs. It requires a 48K Model I disk TRS-80. Price is $995.

Citation Group, 13 Langhorne Rd., Chalfont, PA 18914. Reader Service number 480.

Apple Accounting

Systems Plus, 3975 East Bayshore, Palo Alto, CA 94303, is adding a general accounting package for the Apple II and Apple II Plus to its product line. The Accounting Plus][package includes General Ledger, Accounts Receivable and Accounts Payable.

It is written in Apple BASIC and assembly language. The system is totally integrated and menu driven, with user prompting. It supports two or three floppy drives or hard

disk, and most 80- or 132-column printers. The program can maintain up to 300 customers, 300 vendors and 500 charts of accounts. The price for the three modules is $995. Reader Service number 472.

TRS-80 Model II Software Security

The Management, PO Box T, Aledo, TX 76008, is now offering a software protection package for your TRS-80 Model II. The Locker does not modify your BASIC program, but LIST and LLIST will not work, so your program is protected from unauthorized modification and/or plagiarism.

This software extension enhances the standard TRSDOS 2.0 operating system and BASIC. It requires no additional RAM or disk space. Each SYSTEM disk can be individually protected. The price is $24.95 (checks only), and installation instructions are provided. Reader Service number 465.

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BASIC for CP/M Users
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CBASIC2 from Lifeboat

Limit yourself no longer to the BASIC that came with your machine. Give up apologizing for its inadequacies. Refuse to spend hours programming around its deficiencies. With CP/M, you can choose eight versions of BASIC from Lifeboat Associates alone. One is CBASIC2, sold by Lifeboat Associates of NY and Software Systems of Sierra Madre, CA.

This version of BASIC is neither fish nor fowl. It is a semi-compiler—it compiles now and translates later. Unfortunately, final programs are not as compact as output from a true compiler, and a translator program must be in memory when the program is run. You need 24K to use CBASIC2 but only 17K to run the translator and the semi-compiled program.

Another oddity of CBASIC2 is that it isn't used when you write your programs. Instead, it stays on disk while you use a text editor to write programs, which are then stored on disk as CP/M files with the file named ending in the three letters ".BAS." In most cases, this would mean using CP/M's ED program. But if you are going to use CBASIC2 a lot, get another text editor! I use the Electric Pencil II to write the program. Then I use Michael Shrayer's program CONVERT to convert it to a CP/M file.

You do not need to use line numbers with CBASIC2, unless you are later referring to that line, as with a GOSUB command. However, lack of line numbers prevents you from entering lines randomly, depending on the editor to order them. On the other hand, lack of line numbers gives a program written in CBASIC2 a characteristic appearance that I find pleasing.

Once the program has been written, you simply give the command to CP/M, "CBASIC2 filename.BAS." The file is then semi-compiled to an intermediate file with the same file name but with the suffix "INT." You may have the intermediate file listed to the CRT or printer. Line numbers are assigned to the listing for later reference. Some of the syntax errors are picked up here but you will have to reinvoke your editor, change the source file and then "CBASIC2" it again. When you are satisfied with the intermediate file and want to run the program, merely command CP/M, "CRUN2 filename.INT," and the program is executed.

However, you are still not out of the woods. If any errors occur while running, an error message is given. But the line numbers refer to the line numbers in the intermediate file. It is then back to the source file and the editor.

This jumping back and forth from source to intermediate files and from CRUN2 to CBASIC2 to editor is what is casually referred to in the advertisements as a noninteractive BASIC. You cannot make changes in your program as it runs.

But don't be put off by these procedures. CBASIC2 will reward you for your perseverance. First, CBASIC2 has to be the most extensive version of BASIC that I have seen. I cannot find any commands that have been left out (although I haven't given up looking). You will find WHILE . . . WEND, CHAIN and RENAME.

Second, if you are selling your software, you can sell the INT file alone; it cannot be listed without the source file yet it cannot be disassembled with an ordinary disassembler since it is not in machine code! Third, the semi-compiler runs faster than the usual BASICs.

A strong point of CBASIC2 is naming variables. You can use 31-letter names. No more using A for apples, B for bananas, C for coconuts and then wondering what to use for apricots. This alone will increase the readability of your programs by 100 percent—assuming that they are worth rereading. Variables can be real, integer and string. This is true of most BASICs, but CBASIC2 lets you interchange these whenever it is convenient for you.

Don't try to fault the string-handling functions of CBASIC2. There are 11 string functions. Manipulate your strings to your heart's content. I cannot envision any operation that you cannot perform in this version of BASIC.

Standard predefined functions such as TAN(X), SQR(X) and LOG(X) are present, but so are many extra ones. There is an INT(X) function to return the integer fraction of X, but there is also an INT$(X) function that converts X to an integer. The RND(X) function will give you a random number, but you can also use the RANDOMIZE function to generate a truly random series based on response time to an input. UCASE$(X$) will convert all lowercase letters in X$ to uppercase. I haven't figured out a use for this yet. Note that there is no renumber command—you don't need it.

CBASIC2 is disk-oriented. Its file structures use all the power of CP/M but even more effortlessly. Use either sequential or random access. Open, close, rename, update and delete files. Create new files during the running of the program. Even create file names from variables in the program. The housekeeping is done for you. PRINT to disk files for later spooling to a printer.

CBASIC2 has a formatted print output. It is very similar to that used by Radio Shack. This will make translating programs easier. More importantly, it will give you great flexibility in business programming where reports, ledgers and columns of figures are common. Even the output of the disk can be formatted.

In summary, CBASIC2 is not the perfect version of BASIC—there is no such thing. However, it allows programmers with CP/M to use BASIC to its fullest, with all positive features accentuated but most warts hidden. CBASIC2 is an excellent buy.

Bruce Evans
16 Marwin Road
Pickering, Ontario
Canada L1V 2N7

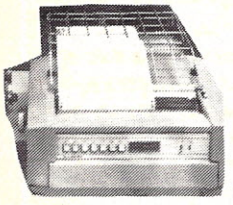
BPI Systems General Ledger

In the past few months several excellent business software packages, including the BPI Systems General Ledger, for the Apple II have become available. This software is one module of a system that includes accounts receivable and payable, inventory control and payroll. The

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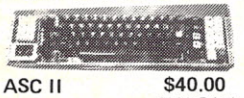
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accounts receivable and inventory modules are currently available, with the release of the other modules expected soon.

The BPI General Ledger software allows you to set up and maintain a computerized bookkeeping system that includes a custom chart of accounts (up to 400 accounts are allowed), a large number of subsidiary ledgers (journals) such as an invoice register, merchandise purchased journal, as well as cash sales, cash receipts and cash disbursements journals.

While not every business needs (or even wants) to use all of these journals, their availability means that a large number of businesses could use this module as their only accounting system.

Data entry into the general ledger system is simplified and speeded by user-supplied prompts for many of the journals. For example, instead of entering a name and account number for a cash disbursement entry made to the same person every month, the operator enters "P1" or "P2" and so on, and the system will put on the screen the name and general ledger account numbers associated with this prompt.

A check, entered through the cash disbursements journal, can be distributed to multiple general ledger accounts (for example, a check to your landlord could be broken down to rent, electricity and taxes).

Once all the journal entries and other transactions for the month have been entered, all further processing, such as printing a general ledger, trial balance and financial statements, can be automatic, with no additional attention from the operator. This is accomplished by a "command queue" similar to that usually found on minis or mainframes.

The system is supplied with a 100-page manual which contains some of the best-written documentation I have ever seen on a micro, mini or mainframe. The documentation assumes no background in either accounting or computers, and even an absolute layman should have no trouble using the software.

The software is supplied on three diskettes, and a fourth diskette contains a complete sample set of books to practice using the system (a thoughtful addition). Also included is a small ROM chip that must be plugged into the game paddle socket. Without this chip the system will not boot or run. With the chip installed, you are able to back up the programs on disk. In fact, my copy of the package included a set of preprinted labels for the back-up disks.

While the software does have two limitations (Applesoft's nine-digit limitation, and the payroll ledger's handling of FICA, federal withholding tax and "other deductions"—no separate reporting of state, city or other miscellaneous deductions), these are minor and should not have a major effect on most users.

All things considered, BPI provides an excellent software product for an extremely reasonable price ($400). This software compares favorably with software ten to 15 times its price which I have used on large minicomputers.

Ted Needleman
President
Idea Technology
67 West Burda Place
Spring Valley, NY 10977

Star-Kit's BASIC-Up

Any 6800 user who reads *Microcomputing* is sure to know Peter Stark from his SWTP and Kilobaud Klassroom series. Peter (Star-Kits, PO Box 209, Mt. Kisco, NY 10549) is offering a BASIC utility package for the 6800. BASIC-Up is a set of six disk-based utilities designed to make life easier for the programmer. It is priced at $30 and is available in versions for the Percom disk with Super BASIC, Flex 2 with TSC BASIC and Mini-Flex with SWTP disk BASIC.

The heart of the package is BEDIT, a mini-editor that renumbers, corrects line references and searches for or replaces specified strings in a BASIC source file. BEDIT inputs a file, performs the desired editing and lists or saves the updated source file. Since BEDIT is a machine-language program, renumbering is fast. A 100-line program can be renumbered in less than nine seconds.

The program is renumbered in increments of ten, starting with a user-specified line number. When line 9990 is reached, BEDIT starts over with line 0000. Care must be taken to check on a possible renumbering overflow. If this occurs, it is a simple matter to renumber starting with a lower line number.

While the source program can be listed on the terminal, there is no pause control. It becomes difficult to read a long source file with a high-speed terminal. A simple pause control would be welcome. This should not be seen as a fault, since BEDIT is not meant to be a full editor; it was designed for renumbering and has a few additional convenience features.

The five remaining programs are written in BASIC and complement the functions of BEDIT. PRETTY creates an easy-to-read, paginated "pretty-printing" listing. It double-spaces around REM statements, moves in-line REMs to column 50, indents FOR-NEXT loops and further indents nested loops. Listing 1 is a PRETTY version of a simple program. A 50-line program takes less than three minutes to list on a 1200 baud printer.

VINDEX indexes and lists all variables and their line occurrences in a source program. A 50-line source program is processed in one minute.

If you have several versions of the same program, BACOMP will read the source files and print only the differences line by line. Each file has a separate column for easy reading. Listing 2 compares two versions of the simple program.

SHORTS shortens long programs. It will remove REMs and correct line references. This alone speeds up many long programs. Lines can also be concatenated up to 72 characters. While this usually slows program execution, it allows a long program to fit into available memory. A 100-line, nine-sector program takes four minutes to read, ten seconds to process and four minutes to shorten. The shortened version saved a full sector of disk space and was shortened to 50 lines.

BENTER is a short utility to create automatic line numbering and saving of programs being written. It asks for a starting line number and the desired line increment. If you do much program writing without an editor, it can be a time-saver.

FLOGEN generates simple flowcharts from a source file. It connects GOTO and GOSUB statements and FOR-NEXT loops. It is very time consuming to run and a PRETTY listing should be as easy to follow.

To fully utilize BASIC-Up, you need 32K of RAM. Most of the programs can be shortened and used in smaller systems. SHORTS will be helpful, but it must itself be shortened manually before it will fit into a 24K system.

All of the programs contain very detailed internal documentation to allow easy modification by the user. The user's manual is highly readable and contains descriptions and sample runs. Following the examples, even a beginning programmer will have little difficulty using BASIC-Up. It is a welcome addition to the toolkit of any 6800 BASIC programmer.

Dennis Doonan
2307 Carlisle Ave.
Racine, WI 53404

```
PRIMES   10/15/1980   PAGE 1

0001 REM PRIMES VER.1
0002 REM SUPERBASIC VER.1.0C

0005 LINE=64
0010 PRINT "PRIMES": PRINT
0020 PRINT "1 2 ";
0030 FOR A=3 TO 1000 STEP 2
0040      C=0 : D=SQR(A)
0050      FOR B=300 TO D STEP 2: E=A/B
0060           IF E=INT(E) THEN C=1: B=D
0070      NEXT B
0080      IF C=1 THEN 100
0090      PRINT A;" ";
0100 NEXT A
0999 END
```

Listing 1. PRETTY program.

```
0001 REM PRIMES VER.1
          0001 REM PRIMES VER.2
0002 REM SUPERBASIC VER.1.0C
          0002 REM PRIME NUMBER GENERATOR
0999 END
          9999 END
```

Listing 2. BACOMP program.

(From page 258.)

old system, because it simply may not have existed in the old system. Parallel testing, then, is not always possible.

Inherent with a newly computerized system is the method of loading the data for the first time. It must usually be manually loaded, which introduces a certain amount of error.

In general, then, the actual conversion testing becomes more important, as it may be the only available means of assuring a workable, reliable computer system.

So far, only systems with newly developed software have been discussed. For many sites, however, the system may either come as a packaged, "turnkey" product, or it may at least use software packages available from various vendors. Here, the greatest battle exists between the vendor and the purchaser. The vendor is trying desperately to protect its proprietary interests by not letting out too much information about its software. This often results in inadequate documentation, lack of source code, lack of comments in the source code or unnecessarily complex inner workings. The buyer must try to obtain as much information as possible to make a good purchase decision, make changes as necessary to customize the package to his needs and ultimately support the entire software system if the vendor is no longer around.

The buyer must make several choices when looking to use packaged software. First, is the price or value great enough that he is willing to accept a package where the source code is not available? What will happen if the vendor no longer can support the software? How much enhancement will be needed in the future as a normal course of doing business? And certainly, does the package take the anticipated computer to its limit of speed or capacity from the start?

Operations

The major differences between "data centers" based on large and small computers appear to be in the areas of cost-effectiveness of the environmental controls, the reliance on environmental controls, the day-to-day operations and the changes in control responsibilities.

Cost effectiveness of environmental controls—While the computers are getting less expensive, the corresponding environmental controls are not. If a bank did your payroll for you, it would be done in a fire-protected, air-conditioned, highly secure area with backup power supported by a backup facility. How many business or commercial users of microcomputers have even so much as a fire extinguisher by their computer? And of those, how many have the kind that is not potentially as destructive to the equipment as a fire? Is the computer specifically identified on the insurance policy? Has the coverage been increased to cover the asset which in some cases is worth more than all of the other furniture and fixtures combined? How many times a day or week can the computer program die because of the interference generated by a nearby motor or other heavy-duty device?

These are just a sample of the questions that an auditor would ask if he was reviewing the operations of a site with a newly acquired computer. It is important to understand that a good auditor will not demand the presence of the same level of controls as that bank, but he will demand a cost-effectiveness analysis to show which controls cannot be justified.

Reliance on environmental controls—If the level of control of the computer environment is less than a mainframe, the reliance on the level of control present cannot be as great, either. Here, perhaps a distinction must be made between the uses of the local microcomputer. A machine that performs nothing more than calculations to relieve the user of much manual effort has different backup requirements than one which stores databases critical to the continuing operation of the user's business. In other words, a slowdown in operations where manual effort must take the place of a "down" computer probably is not as critical as a situation where the database necessary to operate has been lost or is inaccessible. The auditor will not suggest equal levels of reliance on environmental controls for all sites. He will require proof, however, that each user has addressed the issues of physical controls, their cost-effectiveness and the amount of reliance which can be placed on those controls.

Operations processing methodology—Probably the major difference between the operations of large and small computer sites is the organization of the people that operate the machines. Separation of duties is one of the main points of efficiency and control in a large site where people can specialize but are also not allowed to have control over too large a portion of an application. In many small computer sites, however, it is unrealistic to think that the entire operation of the computer could be delegated to any more than two people. How do we, as auditors, allow full control of an application from start to finish where one of the prime controls is impossible?

The inability to segregate the duties of the people responsible for the functions of the computer is probably just an extension of the problem that existed before the computer was installed. The most important point is that the manager should not lose sight of the situation just because it is now computerized.

He or she must take an active role in the control portion of management. That may take the form of periodic checking or balancing. If the installation of a computer indeed requires fewer people to perform that portion of the operation, the natural time to readjust the mix of duties for each person is during the installation.

Measures for Improving Control of Microcomputers

Auditors must always keep in mind that this is the real world. That may not sound profound, but it is the single major complaint about auditors and one of the most difficult complaints to overcome. After being involved with a number of installations of microcomputers used for business and commercial uses, I have come up with these real-world controls for the small computer site:

1. Monitor the implementation of systems into each area or application. Treat each new major program as if it were the first one installed.
2. Cripple all utilities that can circumvent or modify software and files. These may be kept elsewhere, but they do not need to be readily available to the operators.
3. Limit the use of software documentation to authorized personnel.
4. Standardize, standardize, standardize. Require that programs be written in the same language and that they use the same basic method of obtaining input from the operator. Controls such as these are not overhead. They constitute good data processing.
5. Back up and store copies of files and programs. The manager should test this periodically.
6. If possible, separate data entry operations from processing.
7. Develop at least a simple password system for critical files.
8. Control the changes to programs. Uncompiled BASIC is great for program development. It is an auditor's nightmare to assure control over time because the operator can change the program at will.
9. Decide ahead of time the basic standards for canned programs to be purchased. How much is it worth to have source code available? What happens if the vendor no longer is available? How much documentation is needed to assure complete self-support of the program if it is necessary.

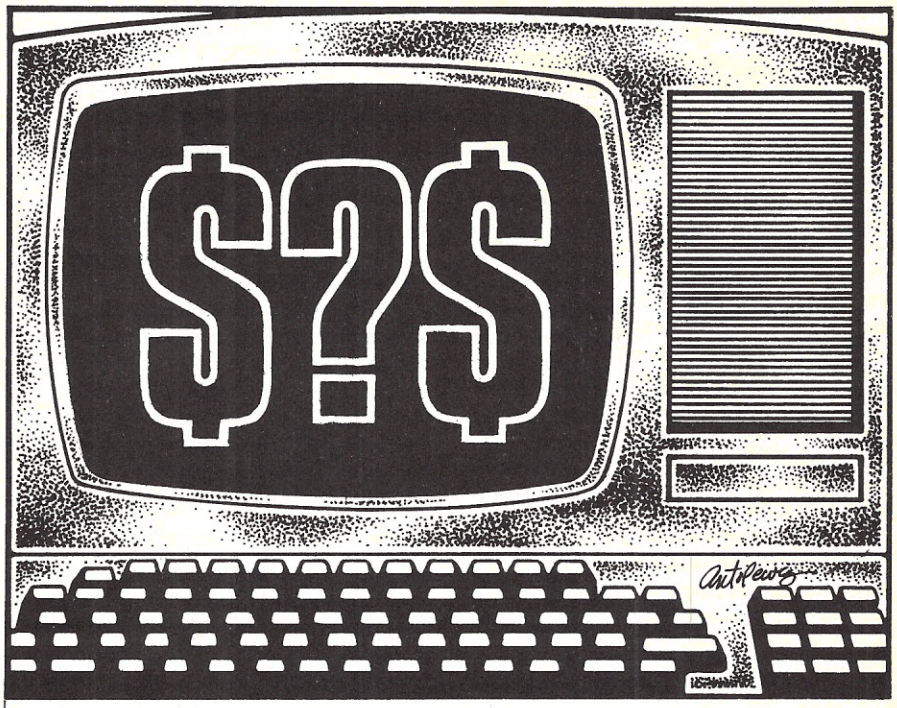
Summary

Microcomputers have already been demonstrated to be pivotal in many business efforts to compete. Their unmanaged application could have enough impact to pivot the business in the wrong direction. No specific controls or safeguards exist for all applications of microcomputers, but a general awareness of the control areas and a positive, managed approach will surely create an atmosphere conducive to good data processing.□

By Robert D. Hodge

An Auditor's View Of Microcomputing

Protecting Your Dollar Investment



Microcomputers have touched many areas and phases of business which have before been impervious to the aid of computers because of cost. The small store or shop can now use a computer instead of a full-time bookkeeper. Word processing and database management permits better marketing efforts from more available information being used in a more timely, efficient manner. Unique, complicated analyses previously performed by highly-skilled technicians are now performed by small computers using off-the-shelf software. No end is in sight for new applications of microcomputers where computers have never before been feasible.

But without sufficient management understanding of the complete application, many microcomputer users may be doomed to suffer the same chaos of the 1960s-era mainframes. Simply, the user may become so enamored of managed applications that he bypasses the understanding, planning and controlling phases of development and operation. How many of us have plugged in a new component or computer without first reading the instructions?

The concerns of an auditor should be those of the manager. They are responsible for protecting the assets and assuring efficient operations. Let's look at the differences that commonly occur in the development and operation of large and small computers and what can be done to prevent the same mistakes of 20 years ago.

Systems Development

The major differences are in the areas of project management (cost, manpower and time needed to develop a system), the development method and the conversion method.

Project management—We hope that the cost and manpower necessary to develop a system is less than it would be on a larger computer with its associated overhead. But that overhead includes good planning. On one side, it doesn't make sense to perform a $2000 feasibility study if the system may only cost $4000. On the other side, too many managers have been caught up in the cheap prices of the hardware and have forgotten that the price and time of the people that program it is the same as with big computers. Project management in the areas of the feasibility study, user walkthroughs and progress reporting is still necessary with small systems; its extent must be in the proper relationship to the anticipated size of the system.

Development method—The early mainframe computers had limited CPU speed and limited memory. Much of the total development effort went towards making the program fit into the computer and work efficiently. With rising programmer costs and decreasing hardware costs, program efficiency on mainframes has been given a lower priority, and rightfully so. But doesn't this early mainframe problem sound familiar to microcomputers? It suggests several concerns which an auditor will trace:

1. A larger proportion of development effort must be allowed for capacity planning than for the large computer counterparts of today. A common concern today is that: Given a set amount of disk space, printer speed, CPU speed and memory available, many microcomputer systems are close to a full configuration when purchased for business or commercial uses. There is no room left for expansion.

2. With the great variety and turnover of microcomputer and peripheral vendors, a greater proportion of design effort must be devoted to price versus risk considerations. Just how much is that $100 cheaper disk drive worth if you don't have local maintenance or continuing national support? An auditor won't demand that the better-supported software or hardware be purchased or leased. He will simply request evidence that the value of the item purchased or leased is the best value available in terms of price and risk.

Conversion methods—Often, the conversion from a manual to a computer system provides a lot of new information in the form of totals, cross-references or complex analyses of data. That new information may not be traced easily to the

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